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AUTHOR	Vickery, Brian C.; And Others
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ABSTRACT

The main objective of this comparative survey of the use of classification in science information is to explore the possibility of adopting a standard general classification in this field. Classification is defined as the grouping, division and/or sequencing according to meaning, of subject representations such as catalogue or index terms, descriptors, etc. Classification is used in "intermediate" documents (bibliographies, abstracts, indexes, etc.) to arrange entries in a meaningful sequence and to structure the relations between subject terms. Classificatory arrangements used in a number of secondary publications are compared with general classifications and with each other. Classificatory relations used in some major thesauri are also compared with general classifications and with each other. The general classifications differ from the intermediate documents with which they were compared in two ways: they lack some of the subject terms used by the documents, and differ in some of their classifactory relations (grouping, decision and sequencing). The overall picture is that, although classification schemes do not occur in all intermediate documents, the use of classificatory relations for both arrangement and thesauric information retrieval is widespread. (Author/NH)

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CLASSIFICATION IN SCIENCE INFORMATION

A comparative study undertaken by

ASLIB

for the International Council of Scientific Unions

as a contribution to

the ICSU/UNESCO study of the feasibility of

a World Science Information System (UNISIST)

Study carried out by: Brian C. Vickery
Margaret Slater
Alexandra Presanis
Rose Reynolds

Aslib
3 Belgrave Square
London, S.W.1.

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SUMMARY

This report presents a comparative survey of the use of classification in science information. Its main objective is to explore the possibility of adopting a standard general classification in this field.

Classification is defined in section A2 as the grouping, division and/or sequencing according to meaning, of subject representations. Such representations (catalogue or index terms, descriptors, etc.) occur mainly in the intermediate documents of science (bibliographies, abstracts, indexes, directories, terminologies, etc.). The report compares samples of classifications used in these documents with various published classifications. These include four general classifications (Dewey, UDC, Bliss, Colon), and special classifications prepared by COSATI, the American Institute of Physics, and others.

Classification can be used in intermediate documents (a) to arrange entries such as abstracts in a meaningful sequence, (b) to structure the relations between subject terms. A preliminary survey, reported in section B1, shows that in many of these documents no such use is made of classification. Among those that do use it, there is very little agreement on classification. Insofar as there is a standard classification used by a minority of documents for arrangement, it is the Universal Decimal Classification (UDC).

Classificatory arrangements used in a number of secondary publications (abstracts) are compared with general classifications and with each other in section B3. It appears unlikely that any of the general schemes examined could serve as an adequate source of classificatory arrangement for secondary publications, and also questionable whether any general classification would adequately cater for all special interests.

Classificatory relations used in some major thesauri (word-lists for indexing) are compared with general classifications and with each other in section C. Once again, none of the general schemes examined could serve as an adequate source of terms and relations for the thesauri studied. Considerable differences also occur among thesauri, as illustrated in sections C4 and C5.

The general classifications differ from the intermediate documents with which they were compared in two ways: they lack some of the subject terms used by the documents, and differ in some of their classificatory relations (grouping, division and sequencing). As far as term content is concerned, UDC is the least inadequate. Of the terms used in the classificatory arrangements of secondary publications, the following percentages were found in the general classifications: Dewey 68%, UDC 79%, Bliss 68%, Colon 55%. Of the terms sampled from the thesaurus "TEST", the following percentages were found: Dewey 26%, UDC 51%, Bliss 21%, Colon 14%. As far as classificatory relations are concerned, no one scheme is noticeably closer to those found in intermediate documents. This is illustrated in sections B3, C2 and C3.

The overall picture is that, although formal classification schemes do not occur in all intermediate documents, the use of classificatory relations for both arrangement and thesauric information retrieval is widespread. The classifications so used are very diverse, and could not readily be drawn from one of the general schemes examined. The causes of this situation, and its implications for standardisation, are discussed in section D of the report.

General classifications are particularly concerned to stabilise the higher levels of their hierarchy, relations between broad fields of knowledge. Yet, with the growing interdependence of science and technology, and the development of new interdisciplinary subjects, it is these relations that become inadequate for newly emerging special interests. This is discussed and illustrated in sections D3 and D4. The report therefore considers the possibility of standardisation at a lower level - at the level of facets (homogeneous sets of terms) that may occur in a number of fields. Recent developments of this kind are discussed in section D6. The concluding section briefly discusses work to be done if standardisation at some level were to be attempted.

The report is supplemented by 27 tables, 18 figures, and references to some relevant literature.

A. INTRODUCTION

A1. Terms of reference

To assist the ICSU/UNESCO study of the feasibility of a World Science Information System (UNISIST), Aslib was commissioned to prepare "a comparative study of classifications".

The UNISIST project was not then at the stage where it could identify the needed uses of classification in a world science information system. To help towards the elucidation of this problem it seemed useful to explore:

(a) at what points in world science information is subject specification required?
(b) to what extent has classification been found useful at each of these points, and what classifications have been used?
(c) to what extent could these classifications be derived from a single standard classification of science?
(d) what are the relative advantages of some existing general classifications for this purpose?

"Science" was taken broadly to include the fields under the aegis of the International Council of Scientific Unions - including astronomy, biology, biochemistry, biophysics, chemistry, crystallography, geology, geodesy, geophysics, mathematics, mechanics, physics and physiology - but in the course of the survey it has at times been necessary to take into consideration material more properly the concern of the Union of International Engineering Organisations and the Council for International Organisations of Medical Sciences.

This report presents the results of our exploration. Because of the volume of world science information, and our restricted knowledge of languages, the material studied was only a sample of the whole. We believe it to be sufficiently representative to illustrate the main features of the current situation.

A.2 The meaning of "classification" in documentation

It is as well to be precise about the object of study. The "classification" of a universe of entities - whether they be animals, plants, chemicals, institutions, books, articles, or words - may involve two operations:

(a) grouping and division : putting together entities that are alike in some way, and keeping apart those that are unlike,
(b) sequencing : arranging the entities of a group in a meaningful sequence.

Either the first or the second operation is essential - without one of them no classification has taken place. If either is used, the other is optional: entities may be sequenced without grouping, and grouped entities may be arranged in a sequence not related to meaning. A third operation is also optional - assigning to each group and each entity a code (notation) that fixes its position in the whole system.

In documentation we are concerned with two types of entity: the physical documents themselves (books, reports, patents, etc.), and words or other symbols that represent other entities (catalogue or index terms, descriptors, class numbers, etc.). Classification is widely used in the physical arrangement of documents, but we have not explicitly examined this (though we have explored the relevance to our problems of library classification schemes). We have studied the application of classification to representations.

Representations themselves are of two kinds - those concerned with the origin of a document (author, publisher, source, etc.), and those concerned with its subject content. Only in the case of the second is meaningful grouping and sequencing relevant. Our study, therefore, has been concerned with the role of classification in subject representations.

The structure of a fully developed classification can be technically described in the following way:

(1) The whole collection (universe) of entities (in this case subject terms) may be divided into a series of fields (for example, Physics into Mechanics, Optics, Heat, Electricity, etc.). Each field is therefore a broad grouping. The fields may be arranged in some meaningful sequence (ref.1).
(2) Each field may be divided into a series of facets (for example,

Chemistry into Substances, Properties, Reactions, etc.). Each facet is therefore a grouping. The facets within each field may be arranged in some meaningful sequence (ref.2).

(3) Each facet may be structured into a hierarchy, subdivided stage by stage by the application of a series of characteristics (such as terms in italics in Figure 1)*. The characteristics are applied in an ordered sequence. Any sequence of terms generated by successive subdivision is a chain (for example, the chain Machines - Mechanical and thermal machines - Nuclear reactors - Heterogeneous reactors - Thermal heterogeneous reactors - Graphite moderated - Gas cooled, in Figure 1). Any one level of subdivision gives rise to a group of terms that constitute an array (for example, the array Bismuth, Lithium, Mercury, Potassium, Sodium, in Figure 1). The terms in each array may be arranged in some meaningful sequence (ref.2).

(4) Rules may be provided for combining (co-ordinating) terms from the same array, from different arrays in the same facet, from different facets in the same field, and from different fields. These rules may involve the use of special relational operators or role indicators. This aspect will not be explored in this report - we draw attention to references 24 and 25.

(5) Each field, facet and term may be coded to fix its position in the whole system, and to facilitate unambiguous combination with other codes.

(6) An alphabetical index to the terms may be provided, showing the code of each.

Where it is necessary to give a technical description of any classification studied, we will use this terminology.

A.3 Subject representations in science information

Scientific communication is concerned ultimately with transmitting information from person to person, from source to user. Interpersonal communication is as important in science as in other areas of social life, much goes on, and some of it is susceptible to organisation (seminars, conferences, etc.). But even where it is organised, the act of organising it usually generates documents

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* All figures are together at the end of the report.

(conference programmes and proceedings, lists of future or past conferences), and in practice the world science information system with which we are concerned is a documentation system. Much scientific communication cannot be other than documentary, because source and user are separated from each other in space and time.

It should be stressed here that we do not restrict the term "document" to mean words printed on paper. Any graphic record can carry information. The physical carrier may be paper or any substitute for it, a photographic medium, a magnetic medium, or any other suitable material. The information may be recorded as words, diagrams, illustrations, in digital form, or in any other way. The only essential features of a document are that it is a record of information, fit for preservation through time, and transmittable in some manner through space.

Documents serve to mediate communication between persons. Because of personal separation in time and space, documentary communication is typically multi-stage. Before a potential user can sit down to study a set of documents providing information (say, scientific papers) he may have to use, perhaps, four intermediate documents: (a) a word-list (terminology, thesaurus, etc.) to help him identify terms under which the needed information may be indexed, (b) an index to published papers, (c) a list of current papers, (d) a guide to libraries that may stock the required papers.

It is these intermediate documents that typically use subject representations - to represent the subject content of a library, a journal, a paper; or to display subject relations between words. Consequently, it is such intermediate documents that we have sampled to explore what part classification plays in their arrangement.

Before reporting on the results of the study, one further aspect of our terms of reference should be discussed.

A.4 The possible role of a standard classification

Classification is not used in all forms of subject representation - for example, an alphabetical subject index may use no grouping or division, and no sequencing other than A to Z (Figure 2). At the other extreme, there are intermediate documents displaying all three operations of classification - division, sequencing and coding (Figure 3). In between, all levels of use of classification are found - some documents use grouping alone, some sequencing alone, some both, but not coding. If current practice is a valid guide, the need for classification varies greatly according to circumstances.

Thinking of a world science information system, we may ask whether all classificatory groupings, sequencings and codings - wherever the need is felt for them - could be drawn from a single standard classification of science. The possible advantages of taking this step might be:

(a) The overall intellectual effort put into constructing classifications might be reduced. The subject areas covered by intermediate documents overlap extensively, and what is approximately the same field is classified - in ways that may differ slightly or greatly - a number of times.

(b) If the same groupings, sequences and codings were employed wherever needed, users might grow familiar with them and find it easier to search in diverse documents.

(c) Integration of or exchange between materials in different subject fields might be facilitated.

Arguments against the use of a standard classification are easy to find. They all rest on the belief that the viewpoint of each specialist group is unique, and that it cannot be expressed adequately by classificatory relations developed for other groups or for the non-existent "general user". We know, indeed, that the mental structure of each individual user is unique, but when one is making publicly available information aids one cannot cater for the individual. Some erosion of uniquely tailored service there must be. The gains achieved at each level of standardisation must be balanced against the losses.

Our remit did not include the making of such a balance, but our intercomparison of classifications throws light on the scale of the standardisation problem that would have to be tackled.

It has been suggested (for example, by G.A. Lloyd of the F.I.D. Classification Department) that "the many proponents of special classifications and thesaurus-type subject lists, which may be excellent and efficient in their own areas, cannot be expected to abandon these in favour of one standard classification ... but they may well agree ... to accept one standard 'switch' language, with which they can establish (a) concordance" (ref. 3).

We will come back to concordances in section D7, but will make one comment here. A classification consists of subject terms and classificatory relations between them. Work has been done on establishing a concordance between terms in two or more classifications (ref. 16) - to show that a term coded PBH in one classification is coded 621-8 in another (many illustrations of this will be given later in our study). But if the relation between PB and PBH represents one subject grouping, and that between 621 and 621-8 represents another, all that we can do is to report a lack of concordance as far as classificatory grouping is concerned (and illustrations of this will also be given later). In this case, all that the "switch" is doing is to link terms with the same meaning, their classificatory relations being ignored. The same task could be performed by a comprehensive dictionary whose entries were numbered (coded) from 1 onwards. The classificatory relations of the standard classification would serve only the "dictionary" function of elucidating, by context, the meaning of each included term. This may be a useful function, but we do not consider it to be the whole point at issue.

To compare two classifications we must, of course, start by discovering terms that they have in common - discovering, in fact, whether their subject fields overlap. But to compare them as classifications we must go beyond this, to examine the grouping and sequencing of the terms in each, and the extent to which these classificatory relations are in accord. It is both these aspects that we have explored in the comparisons to be reported below.

A.5 The surveys undertaken

The first step was to identify the types of intermediate document to be surveyed. For this purpose, several guides to such documents were consulted (these guides are listed in Appendix 1). From descriptions in these, a sample of 1265 intermediate documents that appeared to use subject representations was selected. For each document selected we recorded any classification that was used (grouping or sequencing), and noted whether it was a widely used scheme. The results of this analysis are reported in section B1.

The selected items included indexes and current awareness services, abstracts, journals, bibliographies and a few classified dictionaries. About 100 items were looked at in detail. The diversity of the classifications used suggested that it would be difficult to present meaningful comparisons if too many items were included. The next stage of the survey therefore concentrated on some of the major indexing and abstracting services. The arrangements used in these were compared with each other and with several general library classifications that might be considered as candidates for a standard scheme. The results of this are reported in the remainder of Section B.

It was necessary to restrict the number of general classifications so compared. Library classification has a long history (ref. 4), and many schemes have been produced. We decided to concentrate on (a) the first modern bibliographic scheme, that of Melvil Dewey, which has been continuously revised and developed from its first publication in 1876 to date (ref. 5); (b) the most detailed scheme extant, based on Dewey but expanded and developed by Paul Otlet and Henri La Fontaine into the Universal Decimal Classification (UDC), further development being the care of the International Federation for Documentation (ref. 6); (c) schemes developed by two eminent theoreticians of classification - H.E. Bliss (ref. 7) and S.R. Ranganathan (ref. 8).

We are conscious that this is apparently biased towards English language schemes. Partly this is due to our own linguistic background, but mainly it is because the active development of general classification - outside the UDC - has mostly been carried out in English. Recent schemes in other languages have been restricted as to detail (e.g. Kutter, ref. 9, or Clavier, ref. 10). Many special classifications have been produced (ref. 11).

One type of intermediate document is quite different from the secondary publications mentioned above - word lists such as thesauri that may include thousands of terms, many of which are very specific in connotation. Many thesauri have now been published (ref. 12), but

most are in the field of technology rather than science. We wished to examine in some detail the role that classification plays in large thesauri, and therefore concentrated on the study of three examples of major importance but of very different coverage and structure:
(a) the Thesaurus of Engineering and Scientific Terms (TEST), developed jointly by the U.S. Office of Naval Research and the Engineers Joint Council (ref. 13); (b) the Medical Subject Headings (MESH) of the U.S. National Library of Medicine (ref. 14); and (c) the Euratom thesaurus developed for the European Atomic Energy Community (ref. 15). Again we must admit to an English language bias, but for the same reasons as already advanced for classifications - it is in English that most thesaurus development has been undertaken. Comparisons of the classificatory relations of these thesauri with those of the library classifications are presented in Section C.

Our survey results are thus reported in Sections B and C, supplemented by material in appendixes. In Section D we give a general discussion of the current state of classification in the documentation of science.

B. CLASSIFICATION IN SECONDARY PUBLICATIONS

B.1 General Survey of intermediate documents

The preceding section has noted that a sample of 1265 intermediate documents was selected from the guides listed in Appendix 1. We mainly included in the selection documents that were formally published or otherwise publicly available, and that listed other publications as their main function. Within these limits, documents covering only a small range were excluded.

The purpose of this operation was to sample the extent to which classification is actually used in intermediate documents and, where used, the extent to which general library classifications occur. This information was obtained about each document selected - either from descriptions given in the source guides, or by actual examination of the documents. The results are summarised in Table 1 on the next page.

Over half the sample used no classification, relying instead on alphabetical, geographical or form arrangements. Of the 44.4% using a classification, 37.4% used one privately devised, and only 7% of the sample used a general library classification (usually the Universal Decimal Classification, UDC).

This general survey therefore illustrates, first, that many intermediate documents in science make no use of classification; second, that among those that do use it there is very little agreement on a standard classification; and third, that insofar as there is a standard in minority use, it is the UDC.

The next question to be asked was, to what extent do the private classifications match general library classifications? Do they show merely minor divergences, or do their structures differ markedly both among themselves and as compared with general schemes? In order to reduce this problem to manageable size, it was necessary to make a much narrower selection of items for survey in detail. The classifications chosen for study are presented in the next section.

B.2 The classifications surveyed

We wished to compare classifications in some typical intermediate documents with some general library classifications, and

TABLE 1

ANALYSIS OF INTERMEDIATE DOCUMENTS TO SHOW USE OF CLASSIFICATION

	Total (100%)	No Classification*	Own Classification	Library Classification	Type of Library Classification Used		
					UDC	Dewey	Other
Total	1265 (100%)	703 (55.6%)	473 (37.4%)	89 (7.0%)	75	9	5
Sci/Tech (General)	436	298 (68.3%)	97 (22.3%)	41 (9.4%)	32	7	2
Maths & Nat.Sci.	38	19 (50.0%)	15 (39.5%)	4 (10.5%)	4	-	-
Astronomy	30	21 (70.0%)	7 (23.3%)	2 (6.7%)	2	-	-
Physics	54	20 (37.0%)	32 (59.3%)	2 (3.7%)	1	1	-
Chemistry	47	26 (55.3%)	19 (40.4%)	2 (4.3%)	1	-	1
Geology (inc.Geog.)	64	35 (54.7%)	21 (32.8%)	8 (12.5%)	8	-	-
Palaentology	2	1	1	-	-	-	-
Anthropology	21	11 (52.4%)	9 (42.9%)	1 (4.7%)	-	-	1
Biology	30	15 (50.0%)	15 (50.0%)	-	-	-	-
Botany	18	12 (66.7%)	5 (27.8%)	1 (5.5%)	1	-	-
Zoology	24	13 (54.2%)	10 (41.6%)	1 (4.2%)	1	-	-
Applied Sci.(Gen)	45	19 (42.3%)	24 (53.3%)	2 (4.4%)	1	-	1
Medicine (inc.Vet.)	183	106 (57.9%)	75 (41.0%)	2 (1.1%)	2	-	-
Engineering & Technology	185	73 (39.5%)	92 (49.7%)	20 (10.8%)	19	1	-
Chemical Industry	88	34 (38.6%)	51 (58.0%)	3 (3.4%)	3	-	-

Notes: (1) Percentages given horizontally
(2)* Alphabetic arrangement; alpha-classed arrangement; geographical or form arrangement; no discernible arrangement

selection in both groups was necessary. Among intermediate documents we concentrated on classifications used for arrangement in major abstracting and indexing services in science, namely:

Bulletin Signalétique, of the Centre Nationale de Recherche Scientifique, Paris (BS)

Referativnyi Zhurnal, of the Institute for Scientific Information, Moscow (RZ)

Mathematical Reviews, of the American Mathematical Society, Providence, R.I.

Zentralblatt für Mathematik und ihre Grenzgebiete, Berlin

Astronomischer Jahresbericht, Berlin.

Physics Abstracts, London

Physikalische Berichte, Braunschweig

Solid State Abstracts, Cambridge, Mass.

Chemical Abstracts, Columbus, Ohio.

Current Chemical Papers, London

Chemisches Zentralblatt, Berlin and Weinheim

Biological Abstracts, Philadelphia

Berichte über die gesamte Biologie, Abt. A, Berlin.

International Abstracts of Biological Sciences, Oxford.

The classifications in these documents all show a fully hierarchical structure. They have been compared with four general classifications. All four cover the whole field of knowledge. Three (those of Dewey, Bliss and Ranganathan) were designed for the classification of books on shelves and the cards corresponding to them in catalogues, while the fourth (UDC) was envisaged from the start as a tool for information indexing (though it has also been widely applied in shelf arrangement). Detailed descriptions can be found in works already cited (ref. 4) and in prefaces to the schemes themselves. Here we present a brief technical analysis of each scheme, using the terminology introduced in section A2.

The Dewey Decimal Classification (ref. 5) was first published in 1876. It is now in its 17th edition, prepared by the Decimal Classification Office at the U.S. Library of Congress. It is - at any rate on the surface - a hierarchical division of all knowledge on a decimal basis. There are 9 main classes, of which number 5 is Science; there are 9 sciences, of which number 5 is Earth science; there are 9 areas of earth science, of which number 1 is Physical and dynamic geology; this in turn is divided into 9 parts, and so on in successive subdivisions. A sample page is shown in Figure 4.

There is no clear demarcation of fields, since any class at any level can be regarded as the "field" in which its sub-classes are included. There are occasional but unsystematic formulations of facets that can be combined - an example is seen in Figure 5: in the facet "Dynamics of the sea", Ocean currents can be "divided like" (combined with) the facet "Specific oceanic bodies". Most arrays at each level are arranged in a sequence believed to be meaningful and helpful, though the sequencing principle may not be obvious (consider the "specific oceanic bodies" in Figure 5). Each chain of classes may be represented by subdivisions of the notation, for example: 550 Earth sciences, 551 Gross structure and properties of the earth, 551.4 Geomorphology, 551.47 Dynamics of the sea, 551.471 Dynamics (currents) of the North Atlantic Ocean (e.g. the Gulf Stream). We may note, however, that a missing link in the chain, Oceans and Seas, is coded 551.46, and this deviation from consistent hierarchical notation is fairly common. Moreover, many chains end with an uncoded array of more specific terms (such as Heat, Temperature ranges, Isostasy at class 551.12 in Figure 4).

The Universal Decimal Classification (UDC, ref. 6), originally based upon Dewey's scheme, was first published in French in 1905. It is continually being developed and expanded by international co-operation, the work being co-ordinated by the International Federation for Documentation. In broad outline its structure corresponds to the Dewey scheme - for example, 551.4 is Geomorphology in UDC as well as in Dewey - but it diverges in two respects: first, in many of its detailed subdivisions, and second, in its more complex classificatory structure. This can be illustrated more readily by an extract from technology rather than from science (Figure 6).

The fields into which the UDC is divided are signalled by the appearance of distinctively coded facets. Class 66, Chemical industry and technology, is divided into three notational blocks : those in which the code is followed by a hyphen, those in which it is followed by a zero, and those (not shown in Figure 6), in which it is followed by another numeral. The first block is a facet covering general attributes of chemical products, plant and processes; the second covers specific operations, unit processes and plant used in chemical industry; the third lists specific types of chemical product (e.g. 661.72 Alcohols, 667.2 Dyestuffs). These facets can be combined, for example 661.721 - 932 Methanol : continuous processes; or 667.212.31.067.4 Acridine dyestuffs : pressure filtration. As hinted at in classes 66.022, 66.023 and elsewhere, any class can be combined with any other in the classification by means of a linking colon; thus 66.023:621.642.1 represents (somewhat clumsily) Containers, portable. Sometimes, within a field, a sub-field has its own display of facets - for example, a sub-field within 66 Chemistry is 669 Metallurgy (see Figure 7). There are other combinatory devices available in the scheme. As to arrays and chains, the same remarks apply as for Dewey, though there are fewer chains ending with uncoded arrays.

The Bibliographic Classification of Bliss (ref. 7) was published in outline in 1935, its expanded form began to appear in 1940, and a second edition in 1952. Additions and corrections have since been provided by an informal group of users, and a third edition is planned. Once again, on the surface it is a hierarchical division of all knowledge, but using as a notational base the letters of the alphabet rather than numerals. The hierarchy differs considerably from Dewey and the UDC, even at the higher levels - particularly in that it draws in applied sciences as subdivisions of the pure sciences (for example, CT Applied Chemistry, is part of C Chemistry, whereas in Dewey, 54 Chemistry and 66 Chemical Industry are in separate main classes).

To some extent, fields are recognisable as two-letter classes, as for example in the summary of main class D (Figure 8). There is usually no clear division into facets, although a number of "special auxiliary schedules" are provided which are combinable with other classes. For example, codes from Figure 9 are combinable with codes for specific plants, thus FTLV, I represents Onion : physiology. Clear representation of chains has been sacrificed in order to provide a brief notation. Figure 10 illustrates two aspects of this: classes ENE and ENF would appear, semantically, to be subdivisions of END, but this is not shown by the notation; and all their possible subdivisions are not coded, but listed en bloc. For the same reason, arrays are not clearly distinguishable, but where they exist are arranged in a meaningful sequence.

The Colon Classification (ref. 8) was first published in 1933, and is now in its 6th edition. It is still under the direct control of its Indian author, S.R. Ranganathan, who has been most active in exploring classificatory structure. Colon covers the whole of knowledge, and displays structure explicitly. It is divided first into main classes such as C Physics, and these into "canonical divisions" (Figure 11). These are its fields, and the facet structure of each is immediately stated in symbolic form. Thus C3(P) : (E) (2P) implies that there are two facets in Sound, symbolised as (P) and (E) cum (2P), that can be combined. The terms ("foci") included in each facet are then listed in hierarchical form. Arrays are usually in some meaningful sequence. Chains are usually clearly represented by hierarchical notation - e.g. C Physics, C3 Sound, C33 Ultra sound, C33:3 Ultra sound frequency, C33:38 Ultra sound frequency analysis. However, as Ranganathan has begun to develop detailed expansions he is sacrificing hierarchy to brevity in his notation. These expansions are occurring piecemeal, and in general Colon's classification of science and technology is very unevenly developed.

One last classification will be mentioned. In 1964, the Committee on Scientific and Technical Information of the U.S. Federal Council for Science and Technology issued the COSATI Subject Category List (ref. 22). It was put forward as a suggested uniform subject arrangement for the announcement and distribution by U.S. agencies of scientific and technical reports. An extract from the list - concentrating on fields related to science rather than technology - is presented in Appendix 2. Dewey, UDC, Bliss and Colon class numbers are shown against each listed group. The COSATI list displays classificatory grouping, but not meaningful sequence - both levels of array are alphabetical.

B.3 Comparison of Classifications

Even with the sample for study reduced to the size reported in the last section, it is not easy to display a comparison of classifications. The method we have adopted is as follows. As a "reference base" we have mainly used the classification used for arrangement in one of the large multi-disciplinary abstracts journals, Bulletin Signalétique. (The choice of this, rather than another such as Referativnyi Zhurnal, was arbitrary.) Against the classes of BS, we placed corresponding class numbers from Referativnyi Zhurnal, the four general library classifications, the COSATI list (where appropriate) and from other schemes examined. In some cases, we used RZ or other schemes as a "reference base", so as not to rely exclusively on comparison with BS. In the case of RZ and some other journals, class numbers had to be devised by ourselves to represent the uncoded classification used. In all such cases, the journal titles are asterisked in the tabulations. As an illustration, we give in Table 2 on the next page an analysis of the main fields of science considered in the survey.

The field names in this table are extracted direct from BS (in all other tables they are in English). The fields are given in the order in which they occur in BS, as shown by the notation on the left. On the right are corresponding class numbers from other classifications. Thus Mathematics may be coded A in RZ, 510 in Dewey, 51 in UDC, AM/AY in Bliss, B in Colon, and 12A in COSATI. Even at this very general subject level, there is considerable difficulty in assigning class numbers. We would not wish to defend all our code assignations against detailed criticism from those more expert in the subject, but we believe them to be adequate to illustrate the situation.

What can be learnt from such a tabulation? (a) In a column, there may be gaps - we have found no codes in the classification readily assignable to some subjects (the only possible example of this in Table 2 is an apparent gap in the COSATI column for 214 Géologie Appliquée). The number of gaps is indicated at the foot of each column. (b) In a column, the sequence of codes may diverge from the alphanumeric, indicating that the sequence in that classification differs from the sequence in the reference base. For example, in the Bliss column of Table 2, we see inversions of alphabetical sequence as B follows D, BE follows BT/BL, C follows CH, and so on. The number of inversions is indicated at the foot of each column. (c) Any one coding in a column may be multiple - for example, in the UDC column we have 52 + 551 and 549 + 55. (We have not treated consecutive classes, such as 531/536, 537/538, B + C or E5 + 6, as multiple coding.) This indicates that a subject treated as a single class in the reference base is spread over

TABLE 2

BULLETIN SIGNALÉTIQUE - MAIN DIVISIONS CONSIDERED

		Ref.Zh.*	Dewey	UDC	Bliss	Colon	COSATI
110	Mathématiques pures et appliquées	A	510	51	AM/AY	B	12A
120	Astronomie, astrophysique, physique de globe	B+C	520+551	52+551	< D	B9	03+08
130	Physique mathématique, mécanique, acoustique optique, chaleur, thermodynamique	D+E	530/536	531/536	B	B7+8+C	20A+D+F +K+M
140	Electricité	<E	537/538	537/538	BJ/BL	C6	20C+09
150	Physique et technologie nucléaires	E3	539.7	<539.1	<BE	C9B3	18+20G/I
160	Structure de la matière	E5+6	539.1	539	BE	C2	20L
161	Cristallographie	F1a3	548	548	<CH	H1:8	20B
170	Chimie	F	540	54	C	E	07
210	Mineralogie, géochemie, géologie, petrographie	<G	549/552	549+55	CG+<D	<H	08D+G
214	Géologie appliquée	<G	553	553	DO	H7	?
216	Géologie, paléontologie	<G	550/560	<55/56	DG/DY+EP	<H	08G
320	Biochimie, Biophysique, etc.	H+I	574.19	577/578	<E	E9G	06A
360	Biologie et physiologie animales	<I	590	59	GD/GF	K	<06C
361	Endocrinologie, reproduction, génétique	<I	<570	<575/577	<GE+EN	K:6	<06P
370	Biologie et physiologie vegétales	I4+5	580	58	F	I	<06C
740	Metallurgie	J	669	669	CK	E191	11F
Gaps		0	0	0	0	0	1 ?
Inversions		1	4	4	6	7	Note
Multiple codings		0	1	2	3	1	4
16 BS classes							

Note: Since COSATI's fields and groups are only alphabetically sequenced, inversions are not significant.

two or more separate classes in another classification. This is often brought out more adequately in the detailed schedules to be discussed later, where it occurs as "scatter". (d) Some codes in an array of a general classification may be much more specific than others indicating that these subjects are of less relative importance in the classification than in the reference base. This is true of code 574.19 in the Dewey column of Table 2, and many examples may be found in subsequent tables.

This first glimpse at the situation that Table 2 provides immediately suggests differences between the four general classifications and BS. Fifteen steps lie in the sequence from BS code 110 to 740, and inversions occur on average at five of these steps. In contrast, there is only one inversion in RZ, which in this table appears much more compatible with BS.

In Appendix 3 we present tables showing further comparisons between classifications. In the first of these, Table 3, we break down the main fields of Table 2 to a second level, and once again class by RZ, Dewey, UDC, Bliss, Colon and COSATI. The number of inversions is much the same for all columns (even including RZ). In addition, we see gaps developing in all columns. This is to be expected in COSATI, which is a relatively brief list of main fields and their groups, not going into the detail of the other classifications. Some of the gaps in Colon can be similarly explained - particularly those in BS code 740, Metals, since Colon's technology classes are very inadequately developed.

However, gaps can also develop for two other reasons:
(a) Classifications may structure a field differently, laying emphasis on different aspects - thus the BS grouping "Crystalline rocks" at 210E does not appear to be used in the other classifications. (b) One classification may be out of date, not stressing modern developments that others have incorporated - this appears to be the case for BS classes 320D Biological and medical engineering, and 740 IV Lattice defects, which three of the general library classifications do not seem to incorporate.

In Appendix 3, there next follow samples of detailed tables for particular fields of science. COSATI is dropped from the comparison, since it is too general, but abstracting journals other than BS and RZ are brought in. Table 8 uses Physics abstracts as a reference base in the field of Solid state physics, and Table 6 uses RZ as a base for physics as a whole. From all the detailed comparisons we have made, both the samples shown in Appendix 3 and others, the following summary has been compiled (total classes in reference base = 796):

	Dewey	UDC	Bliss	Colon
A. Gaps	253	168	251	338
B. Inversions	188	218	176	143
C. Base minus gaps	543	628	545	458

In this comparison, gaps - indicating the apparent absence of a term in a classification - were greatest for Colon (45%), least for UDC (21%). Since only codes that were present could be inverted, inversions are best reported as a percentage of row C: Dewey 35%, UDC 35%, Bliss 32%, Colon 31% - a fairly uniform picture.

It is of interest to consider how the general classifications as a whole compare with the reference base for each particular field of science. For example, in Table 4 (Astronomy and Astrophysics), we have the following analysis:

	Dewey	UDC	Bliss	Colon	Mean
Gaps	12	8	7	11	9.5
Inversions	12	11	10	12	11.25
49 BS classes					

The average number of gaps per classification is 9.5, of inversions 11.25. The average percentage of gaps is 100 x 9.5/49 = 19%, and of inversions is 100 x 11.25/(49-9.5) = 28%. Similar calculations have been made for a dozen fields of science. The percentage of inversions is fairly uniform, the range being 34 ± 7%. Percentage of gaps varies more widely, with a range of 32 ± 21%. Fields with a high percentage of gaps - indicating considerable difference between the reference base and the general classifications - were Mathematics, Electricity, Structure of matter (Table 7), Solid state (Table 8) and Physical chemistry (Table 10). Fields with a low percentage of gaps (indicating relatively little difference) were Astronomy (Table 4) and the broad groupings Chemistry (Table 9) and Biology (Table 11).

If we look in more detail at inversions of sequence we find that many are due to the fact that a grouping, used by a secondary publication such as BS, brings together classes that are scattered in the general classifications. Consider, for example, the group 120aIII in Table 5, Physics of the terrestial globe. The classes in this group are scattered as follows:

Dewey -	551	Physical and dynamic geology
	525	Earth (astronomical geography)
	526	Mathematical geography
UDC -	525	Earth (astronomically considered)
	526	(528 in 1960) Geodesy, etc.
	550	Geology and meteorology
Bliss -	DQ	General geography
	DFT	Earth as a planet
	DH	Physical geology
	AW	Mensuration
Colon -	U1/2	Mathematical and physical geography
	B91	Earth (astronomy)
	D:2	Surveying
	H4	Dynamic geology

Scatter of this kind is particularly noticeable in Table 7 (Structure of matter) and Table 8 (Solid state physics). The groupings developed by the secondary publications cut right across the traditional groupings of general classification.

In several tables we have compared the selected "reference base" with classifications in other secondary publications - not only RZ, but also Astronomischer Jahresbericht (Table 4), Physics abstracts (Tables 6,7 & 8), Physikalische Berichte (Tables 6 & 8), Solid state abstracts (Table 8), Chemical abstracts (Table 9), Chemisches Zentralblatt (Table 9), Current Chemical Papers (Table 9), Biological abstracts (Table 11), Berichte über die gesamte Biologie (Table 11), International abstracts of biological sciences (Table 11) and, in tables not presented, Mathematical reviews and Zentralblatt für Mathematik. The classifications used by these publications are less detailed than BS or RZ, sometimes amounting to no more than a sequence of fields. As the gaps and inversions in the tables show, the classes selected by these publications, and the sequences used, diverge considerably from those of our "reference bases", and from each other. As further illustration of this, in Table 13 we reproduce the sequences of classes used by four secondary publications in the field of general and physical chemistry, comparing them with those of the four general classifications.

What general conclusions can be drawn from the comparisons reported in this section? We should expect that secondary publications, coping issue by issue with newly published scientific literature, able to change their classification to keep pace with changing emphases in science, will give a reasonable picture of the classificatory relations required by current science. Where a general classification differs from such a "reference base", we would expect the former to be defective. Our comparisons have shown that differences do occur, and detailed study of the tables indicates that in many instances this is because the general classifications are out of date - modern terms are missing, some of their low-level terms have become highly important, they do not provide the classificatory groupings currently of interest. In these respects, UDC is less defective in content of terms (covering 79% of those in our reference bases), but not noticeably better in other respects.

We might therefore conclude that none of the general classifications examined could serve as an adequate source of classificatory arrangement for secondary publications. The fact that arrangements in these publications also differ a good deal among themselves suggests that no general classification, even if up-to-date, would necessarily provide satisfactory arrangements for all the special interests served by secondary publications.

C. CLASSIFICATION IN THESAURI

C.1 The development of thesauri

The general classifications described in section B2, and the many special library classifications that exist (ref. 11), represent one line of development of aids to information search. Parallel with this there has been another line of development, emphasising the use of natural language terms in alphabetical sequence. This too has a long history, less well documented than classification (ref. 17), but as far as the English language is concerned its modern phase was begun in the same year as Dewey first published his classification, 1876, with a guide to alphabetical subject indexing prepared by another American, C.A. Cutter (ref. 18).

Alphabetic lists of terms and subject phrases to be used in indexing have been prepared for many fields (examples of these too are cited in ref. 11). A sample page of such a "subject heading list" is shown in Figure 12. About ten years ago, the word "thesaurus" crept into documentation to label another kind of alphabetical word list (ref. 19). A sample page of the TEST thesaurus is shown in Figure 13. The main difference is that whereas the Figure 12 subject heading "Aeroelasticity - electromechanical analogies" is designed to be complete in itself, usable as a topic description, the thesaurus term "Chemical etching" is designed to be used in co-ordination with others to describe a topic (e.g. Chemical etching of aluminium). (The usage of the word "thesaurus" is now somewhat eroded - there are even "classified thesauri").

During the last decade, many thesauri have been prepared (ref. 12), for use with manual or mechanical "co-ordinate" retrieval systems. Some, particularly those covering a narrow field, are bare lists of allowed indexing terms. But as lists of wider coverage have developed, they have been structured by an elaborate system of cross-references between terms. It is this cross-reference structure with which we will be concerned here, for it is in this form that classificatory relations are encountered in thesauri.

C.2 Classification in TEST

TEST, a Thesaurus of Engineering and Scientific Terms (ref.13), was published in 1967, but is related to an earlier thesaurus of engineering terms published in 1964. A collective work and the joint product of the U.S. Office of Naval Research and the Engineers Joint Council, it includes over 17,000 index terms (and over 5,000 USE references) in science and technology. The main sequence is alphabetical (Figure 13) - each term is listed independently. Italicised terms are USE references. Below each allowed term are cross-references: UF (used for) referring to a term not allowed in indexing, BT (broader term) to a term higher in a hierarchy; NT (narrower term) to a term lower in a hierarchy; and RT (related term) to a term having a close but non-hierarchical relation. A dash against any term in the NT or RT lists implies that it too has narrower terms associated with it.

A second sequence in the thesaurus lists 22 major fields(such as Physics) and sub-fields within each (such as Acoustics), and lists terms that occur within them (Figure 14). A third sequence extracts all broad terms that have at least two levels of narrower terms associated with them, and presents each hierarchy (Figure 15). As can be seen, there is no explicit indication of facets, chains are clearly displayed in each hierarchy, all arrays are in alphabetical sequence, and there is no coding. By linking the second and third parts of the thesaurus, longer chains can be derived, for example: Chemistry - Physical and General chemistry - Chemical reactions - Decomposition reactions - Solvolysis - Hydrolysis - Saponification.

From the third part of TEST, we extracted 54 hierarchies in science rather than technology, and coded them by four general classifications. A single example is presented in Table 14 (Appendix 3). It will be seen that (a) of the 49 terms in the hierarchy, we located only 19 in Dewey, 11 in Bliss, 8 in Colon, and 29 in UDC; (b) some of the locations were not specific, e.g. more than the topic Thermal expansion is covered by Dewey 536.41 or Bliss BHQ, and is indicated by the $<$ signs preceding these codes in the table; (c) the topics in a hierarchy may be scattered in a general classification, e.g. Thermodynamic properties as listed by TEST occur in Dewey classes 536.7, 536.4, 536.2, 541.3 and 537.65.

In Table 15 (Appendix 3) a summary of the comparison is presented showing the hierarchies examined, the number of terms in each, the numbers located in each general scheme, and comments on specificity and scattering. In some cases, the highest term in the hierarchy (recorded on the left) could not be found, and this is signalled by an asterisk: for example, it appears not to be possible to pull together a hierarchy "Body fluids" from any of the four classifications. The overall result of examining 54 hierarchies containing 1893 terms is:

	Dewey	Bliss	Colon	UDC
Terms found in	493	40[illegible]	256	961
Highest term not found	21	20	26	6
Comment "not specific"	24	30	6	1
Comment "scattered"	20	20	13	17

As far as term content is concerned, even in the best performer, UDC, only 961 (51%) were located, with Dewey (26%), Bliss (21%) and particularly Colon (14%) being even more inadequate. Scattering was a common occurrence in all four classifications, but UDC was rarely "not specific" and usually contained the highest term of the hierarchy. The sample suggests, nevertheless, that none of the four classifications would be adequate as a source of TEST terms and hierarchies.

C.3 Classification in MESH

MESH, a list of Medical Subject Headings, was first issued by the U.S. National Library of Medicine in 1960. It is used in indexing for the published Index Medicus, and for the Library's computer-based information system (MEDLARS), and is continuously revised (ref. 14). The main sequence is alphabetical (Figure 16). An italic entry (such as Stelazine) is a not-allowed term with a see reference to the term used for it. The large-type entries are index terms, e.g. STARVATION. Against each are coded references to categorised lists in which they appear (A1, A2, etc.). Against each may also be cross-references: "see also related" (and its reference back, XR); "see also specific" (and its reference back, XS); "see under" (and its reference back, XU); and X, which is a reference back to a non-allowed term. The second part of the thesaurus is a collection of categorised lists (for an example, Figure 17). Each list can be reorganised into hierarchical form (some examples will be given in section C5). From them we can also extract chains, for example: Diseases - Cardiovascular diseases - Heart diseases - Coronary disease - Angina pectoris. There is no explicit division into fields or facets, though each list may be regarded as a facet. All arrays are in alphabetical sequence.

From each of 15 different categorised lists, we constructed a sample chain and compared it to the four general classifications. Sample comparisons are shown in Table 16 (Appendix 3). In Table 17, we report (a) the most specific term in each chain, (b) the length of the chain, i.e. the number of terms from the most general to the most specific, (c) the number of chain terms found in each classification, and (d) a note if the most specific term was not found. The table summary is as follows:

	MESH	Dewey	UDC	Bliss	Colon
Terms found	79	50	59	49	38
Lowest terms not found	-	11	7	10	13

In no classification were all the MESH terms found - the highest percentage was UDC (75%), the lowest Colon (48%). The most specific terms in the 15 MESH chains appeared to be missing in 7 instances even in UDC, and in 13 instances in Colon. In all classifications, there were cases of scattering - as in example 1 of Table 16, where the MESH hierarchy is not mirrored by the notation of any classification examined. The sample suggests, in fact, that none of the four classifications would be adequate as a source of MESH terms and hierarchies.

C.4 Euratom Thesaurus and UDC

The Euratom Thesaurus was first published in 1964, and is an authority list developed for subject control in the Euratom computer-based information system (ref. 15).

It includes about 1200 keywords used in indexing, and another 14,000 non-keywords that are "lead-in" terms, for which the indexer is directed to use an appropriate keyword.

The whole set of over 15,000 terms is listed alphabetically, interrelated by "use", "see", and "see also" cross-references. The keywords are also grouped into 57 clusters or fields, within each of which relations are displayed in a "terminology chart". An example (chart 52) is illustrated in Figure 18.

Each box encloses a keyword, displayed in bold capitals. Within a box, italicised terms are forbidden synonyms, and the other items are related non-keywords. Relations between keywords are shown by lines between boxes, the thickness of the line varying with the strength of the relation. Along the edges of the chart are more distantly related keywords, that will be found in other charts (for example, "Coolants" figures in chart 51, Reactor materials).

Although relations within and between boxes are not explicitly classificatory (hierarchical), we can regard the contents of a chart as a set of terms that it should be possible to draw together from a classification. In order to ascertain whether Euratom charts could be derived from a classification, we compared 13 of them (lying more specifically in the nuclear field) with the UDC special subject edition for nuclear science and technology (ref. 20).

Each keyword and non-keyword in the 13 charts was sought in the UDC schedules, and if present its class number was noted. The results are given in Table 18.

For each chart examined the table shows (a) the number of Euratom keywords it contains, (b) how many of these appear in the UDC schedules, (c) the number of Euratom non-keywords, (d) how many in UDC, (e) how many of the UDC numbers lie within the central core of the field - i.e. within the class corresponding to the chart name. This class is underlined in the final column, which also gives the other classes in which UDC numbers lie. Of the 247 keywords in the 13 charts, 181 (73%) were found in the UDC schedules examined; of the 784 non-keywords, only 84 (11%). Of the 265 UDC numbers noted, 139 (52%) lay within central core classes.

The implication of these figures is that if one used these central core classes as a way of deriving from UDC relations for display in Euratom fashion, one would extract for display only 139 (13%) of the total 1031 keywords and non-keywords that Euratom find it useful to bring together. Some 126 of the terms not extracted are in the UDC schedules, but not in the core classes; the remaining 766 terms are not in the UDC schedules examined.

C.5 Comparisons between thesauri

The incompatibilities between thesauri and classifications, illustrated in preceding sections, can be matched by similar incompatibilities between thesauri. Two illustrations of this will be given.

(a) Euratom and TEST

For each of the Euratom charts previously examined, the core keyword was studied. Each is listed in the following tabulation.

		A	B	C	D	E
Chart	Core Keyword	Assoc: non-keywords	Assoc: in TEST*	Linked keywords	Assoc: in TEST*	Total Assoc: in TEST*
44	Energy	6	1	23	1	11
45	Nuclear reactions	12	0	22	14	58
46	Radiations	8	3	25	8	76
47	Elementary particles	9	2	19	7	58
48	Protons and neutrons	17	1	19	13	63
49	Leptons and hyperons	5	3	16	10	29
50	Reactors	11	10	4	4	62
51(a)	Reactor fuels	3	2	8	6	42
51(b)	Coolants	-	-	5	3	15
51(c)	Moderators	3	1	5	4	9
52	Fuel elements	5	4	5	1	13
53	Reactivity	7	1	25	4	16
54	Radiation detectors	6	3	22	18	57
55	Plasma	16	6	13	8	57
56	Accelerators	6	1	9	9	23
	Totals	114	38	220	107	589

* either as subsidiary terms (e.g. Accelerators, NT Betatrons) or alphabetically (e.g. Accelerators, Accelerator targets).

In its box on the chart, the core keyword was associated with non-keywords, the number being shown in column A of the table. Each core keyword was then consulted in TEST, and the number of the non-keywords that could be associated with it via TEST is shown in column B. In the Euratom charts, each core keyword is linked to other keywords, whose number is shown in column C. The number of these associated with the core keyword via TEST is shown in column D.

The Picture is as follows: in the EURATOM thesaurus, the 15 core keywords examined were associated with 114 non-keywords and linked to 220 other keywords. Via TEST only 38 (33%) of the non-keywords and 107 (49%) of the other keywords were so linked. On the other hand, core keywords in TEST were linked to many other terms not linked in the Euratom charts. The total numbers of terms linked in TEST to core terms are shown in column E, 589 in all. So overall we have:

Links common to Euratom and TEST (38 + 107) = 145
Links found only in Euratom (114 + 220 - 145) = 189
Links found only in TEST (589 - 145) = 444

(b) TEST and MESH

Three fields were selected, representing scientific subjects common to these two thesauri - namely, Biochemistry, Physiology and Viruses. The hierarchical links within each field were traced out for each thesaurus, and are presented in Tables 19 to 21.

The overall picture is as follows:

	Biochem	Physiol	Viruses
Terms common to TEST and MESH	8	8	28
Terms only in TEST hierarchy	26	52	28
Terms only in MESH hierarchy	44	98	17

The way that each thesaurus emphasises different aspects of a field can be seen. In Biochemistry, MESH stresses the details of human metabolism and nutrition, whereas TEST stresses links with Physiology. Neither makes links with biochemical compounds in detail. In Physiology (which overlaps with Biochemistry) MESH again stresses human aspects, and in addition links it with Psychology, whereas TEST's main contribution is to bring in a detailed list of Hormones. The two Virus hierarchies are much more alike, but differ in detail.

D. GENERAL DISCUSSION

D.1 Summary of the survey results

The surveys reported in sections B and C have led us to the following conclusions.

(1) Subject specification is required in many of the intermediate documents used in science information. We have particularly explored its use in the arrangement of secondary publications (section B) and in thesauri used for indexing (section C).

(2) In many of these documents, no use is made of classification in any of the senses defined in section A2. This finding is illustrated in section B1.

(3) Among those that do use it, there is very little agreement on classification. This is illustrated for secondary publications in section B3, and for thesauri in sections C4 and C5.

(4) Insofar as there is a standard classification used by a minority of documents for arrangement, it is the UDC. This is illustrated in section B1.

(5) Of the four general classifications surveyed, none appears to be acceptable as a standard either for subject arrangement (section B3) or indexing (section C).

(6) As far as subject arrangement is concerned, all are lacking in term content, even UDC. Colon is somewhat worse than Dewey or Bliss in this respect. (It should be mentioned that had we explored technology in section B as well as science, this defect of Colon would have been even more marked. It comes out clearly in the comparisons of section C, which strayed more into the technical field).

(7) Hierarchical differences, expressible as gaps, inversions and scatter in our comparison tables (section B3), are widespread - whether we compare secondary publications to general classifications or each group within itself. A particular instance is illustrated in Table 13 of Appendix 3. Such differences are particularly marked in developing subjects such as solid state physics (Table 8).

(8) As compared to thesauri, all the general classifications are inadequate in term content. Once again, at a detailed level,

whether we compare thesauri to general classifications or each group within itself, hierarchical differences are widespread (sections C2 to C5).

(9) Although UDC is more adequate than the other general classifications from the viewpoint of the terms it includes, there is no evidence that its hierarchy is any more acceptable as a standard than that of the others.

In ensuing sections we examine the problems of a standard classification in a more general context.

D.2 The uses of classification in information

The diversity of practice and the difficulty of standardisation revealed by the survey, prompt the enquiry, is there value in classification? is it necessary in science information? can one avoid the difficulties by not using classification?

The need for classification in library arrangement is self-evident. The books in a library form a linear sequence, shelf by shelf, stack by stack. For shelf search - still the most popular form of information search - a sequence based on subject content is most helpful. Library classification - as is clearly evident from the writings of its theoreticians (refs. 1 & 2) - is based on a search for meaningful subject sequence.

The case is not so clear for information search in an intermediate document, a catalogue, or an index, and still less clear for a computer retrieval system. Let us consider in turn various types of classificatory relation.

The division of a collection of items into fields is common in intermediate documents - such as an issue of an abstracts journal. The fields may follow each other in alphabetical order, but a meaningful sequence is often used - as in the examples examined in section B3. It is considered that the information searcher will be glad to find related fields near each other, to facilitate his scanning of the abstracts. In the abstracts journals of wider scope, such as Bulletin Signalétique, there is not only sequence but also classificatory grouping, with sequencing of each array of subclasses.

The division of a field into facets is common in thesauri, as we have seen in the examples of section C. In some cases (such as TEST and MESH) facets may be structured into hierarchies, though within the facet "boxes" of the Euratom thesaurus this is not done. The formation of homogeneous facets is a necessary step in the construction of a logically consistent hierarchy. This in turn is formed because the display of a hierarchy is considered to be an aid to indexer and searcher in choosing a term of appropriate width, and a further aid to the searcher in broadening a search that produces too little information, or narrowing one that produces too much.

The meaningful sequencing of terms in an array is not often found in the thesauri examined. Where it occurs, the justification would be the same as for the sequencing of fields, but an array is usually small, scanned at a glance, and meaningful sequence may be of little help to the searcher.

Both general argument and current practice therefore justify the use of classificatory relations in science information - meaningful sequencing of fields, and the construction of hierarchies. The first relation is used in intermediate documents containing a medium number of items - enough to structure broadly, but not enough to structure in detail. The second relation is used in wider secondary publications and in indexing aids such as thesauri, and hence in any indexes or computer retrieval systems based on the latter. We consider that the evidence of current practice - examples of which have been presented in sections B and C - justifies the use of classificatory relations in science information. The problem of whether they could be standardised, and if so, how, remains to be explored.

D.3 Classification in science

Classification plays a part in most fields of science at certain stages of their development, and is important whenever a large number of similar entities have to be distinguished (plants, animals, minerals, stars, chemicals, etc.). After an initial period of confusion and competing classifications, there is often a phase of strenuous effort to achieve standard classification, with grouping and division based on an agreed set of "essential" characteristics - "natural" rather than "artificial", as the argument runs. Once such a standard has settled down, however, the practical development of a science and its associated technologies often leads to the recognition that other characteristics are equally useful for certain purposes.

This process, as it applies to the classification of chemical substances, has been explored (ref. 21). During the whole period up to the eighteenth century, various characteristics were used to group and divide chemicals: physical state, physical behaviour, chemical behaviour, origin, mode of production. With the developments associated with Lavoisier, constitution became firmly accepted as the basic characteristic by which chemicals should be classified. Since that time, both industry and science have begun to reintroduce earlier characteristics and add still others for certain purposes: bond type, use, scale of production.

The upshot of this is that for different purposes it may be necessary to place a given chemical in different classes: for example, Aniline might be classed as a Benzene derivative, an Amine, a Dye intermediate, a Toxic substance, an Organic base, and so on. The same is occurring in other fields. We are faced, in fact, with an increasing problem of cross-classification, in which an entity may fall into as many classes as there are special interest groups associated with it.

We can extend the argument. A homogeneous group of entities forms a facet, for example, chemical substances. In chemistry, substances are the centre of interest, and a classification will relate them to facets such as structure, physical properties, reactions, environmental conditions. In biology, chemical substances are of secondary interest, as cell constituents and reagents, and a classification will relate them to facets such as organisms, organs, tissues, biological processes. In each field, the same facet (chemical substances) will fit into a different pattern.

These features have led to the proliferation, for purposes of arrangement, of many special classifications, each structuring a field from its own point of view, and thus differing from each other in the grouping and sequencing of the same entities. This has been illustrated with respect to classifications used by intermediate documents in section B, and a study of special library classifications (such as those listed in ref. 11) would amply confirm it. Section C4 has shown that even a single field - nuclear science and engineering - structured from two viewpoints that one would imagine to be similar, may present surprising divergence as to both choice of terms for inclusion, and grouping.

A general classification can adopt one of three ways of meeting this situation: (a) It can firmly place any given entity in only one class, according to what is believed to be its "most generally useful" characteristic. A special interest can only use such a classification as a standard by abandoning any structural relations peculiar to itself. (b) It can place each entity in as many classes as special interests may dictate. It becomes then an assembly of special classifications, held together only by its alphabetical index, and in no sense a standard. (c) It can attempt some uneasy compromise between the two extremes, failing to satisfy any special interest yet annoying the purist by inconsistency.

This last is the path chosen by most general classifications, and the comparisons reported in sections B and C illustrate yet another aspect of the situation. Each chosen compromise differs from the others. This is partly because each classification maker (whether individual or committee) responds differently to the clash of special interests. It is also because interests change with time, and a later classification will emphasise characteristics ignored by an earlier. As a result, each general classification tends to become trapped in a structural framework suitable only to the era in which it was made.

D.4 Current scientific research

The relatively outmoded character of any general classification is particularly evident if we compare it with the most recent developments in any field. In 1961, Unesco published a survey of current trends in scientific research, prepared by Pierre Auger (ref. 32). His classification of material was "based on a functional division of scientific research rather than on a purely academic classification of sciences." Scientific research was taken to include fundamental, applied and developmental research, The overall division of the survey is as follows:

I. Fundamental sciences (mathematical, physical, chemical, biological).
II. Earth and space sciences.
III. Medical sciences.
IV. Food and agricultural sciences.
V. Fuel and power research (thermochemical, hydroelectric, nuclear, solar and electrical energy).
VI. Industrial research (metallurgical, chemical, textile, electromechanical, transport, telecommunications, automation, construction).

Science is seen as existing not only in the disciplines traditionally so labelled, but also in many areas of technology. So division III includes the science of nutrition; division IV includes nitrogen fixation, ecoclimatology, animal genetics, fish population dynamics; division V includes coal structure, radioisotopes, photosynthesis; division VI includes metallography, high polymers, acoustics of buildings. The interpenetration of science and technology is far greater than is suggested by the sharp separations of Dewey, UDC and Colon (Bliss is a little more up-to-date in this respect).

Even if we restrict our examination to the "fundamental" sciences, differences between Auger and the general classifications are immediately apparent. The differences are illustrated in Table 27, in which Auger's 1961 classification of "fundamental" sciences is coded according to the 1965 edition of Dewey. For example, in the main subdivisions of the physical sciences, the traditional disciplines of Mechanics and Acoustics are missing, and Atomic physics, Electronics and States of matter are much more emphasised. One of the six main subdivisions of the biological sciences is Radiobiology, a subject that barely figures in the general classifications.

At the detailed level, Auger is classing, not the whole of science, but its growth points. Yet it is fair to compare his classification with the general ones, because for current and future use they too must cover the growth points. For example, Auger subdivides States of matter into six sections - Fluid mechanics, Solid state, Semiconductors, Superconductors, High pressures, Low pressures. In Dewey, the terms in this array are coded 532, 530.41, 537.622, 537.623, ?

and 533.5 - at very different levels in very different hierarchies.

As a second example, consider Auger's subdivision of Inorganic chemistry. Instead of a simple division by chemical constitution, as found in the general classifications, we get: Inorganic macromolecules, Transition metal compounds, Fluorine derivatives, Compounds for electronics, Materials for astronautics, Metallurgical chemistry, Vitreous state. Again, among the 24 sections of the biological sciences are subjects that are found at a much more specific level in the general schemes - such as Chromosome biochemistry, Transport through membranes, Renal physiology, Cytobiology of radiation.

Particular areas of science rise and fall in importance, new topics continually emerge, the class relations of current interest alter, whole fields are restructured. We found great difficulty in comparing mathematical abstracts journals with the general classifications, and a series of comments by Auger makes this understandable: "modern mathematics uses techniques which were formerly utterly alien to it", "twenty or thirty years ago many good mathematicians still knew very little about vector spaces, etc., to-day they are part of any general mathematical education", "even a few years ago, the methods used in algebra were almost purely algebraic, to-day the situation is entirely different". There is little wonder that both the detail and the overall structure of Mathematics in all the long-established general classifications appears so inadequate.

It has been maintained by some writers that a science can only be properly classified when it has ceased to develop. What is certainly true is that only in a slowly developing field can current documentation continue to use an old classification. The dynamic of modern science is making outmoded the structural frameworks first laid down by Dewey (1876), UDC (1905), Bliss (1935) and Colon (1933).

D.5 The needed level of standardisation

The maker(s) of a general classification typically stand in front of the universe of information, classificatory knife in hand, and decide how to carve it up - into fields, facets, chains, arrays. Most of them spend a great deal of effort discussing the higher levels of the scheme - what fields will be recognised? in what sequence will they be arranged? by what principles will these decisions be justified? A brief history of this aspect of the classification of science has been published elsewhere (ref. 23).

In practice, most general schemes end up by using traditional disciplines as the main fields, and this was explicitly justified by Bliss (ref. 1) as representing the "scientific and educational consensus ... an order likely to persist for centuries to come." In actual fact, although the names of traditional disciplines do persist for centuries, their content (particularly in science) changes continually and rapidly.

The inadequacy of division by traditional disciplines has been discussed by writers on physics, which is still conventionally divided into mechanics, acoustics, optics and so on. It has been noted that this classification of physics was originally based on types of sense perception, but that this method of division has lost its meaning. A century ago, these subfields were separate sciences, in very different stages of development, each following its own line of growth independently of the others. To-day the boundaries between them have almost completely gone. These comments could be illustrated from Table 8 (Appendix 3): from all the "sense-perception" fields of physics, material has been drawn together into a new field, Solid state physics.

The method adopted by makers of general classifications - successive subdivision of the universe of information, successive "expansion" of the scheme to keep pace with the growth of the libraries to which it is applied - of necessity implies an attempt to seek for permanence at the higher levels of the scheme. Bliss and many others have sought for a "permanent" set of fields, "the order of the sciences". Ranganathan has rather sought uniformity in a set of facets applicable to every field (ref. 2). Special classified arrangements, as we have noted, display great diversity. We suspect this to be inevitable.

Each particular intermediate document is (or should be) designed to serve the interests of a particular user group. Increasingly, as science and technology interpenetrate, user interests diversify. The discipline-oriented aids typical of the past give way to, or are complemented by, mission-oriented aids drawing material from many scientific disciplines. The list of science/technology subject categories considered important by COSATI (Appendix 2) is sufficient illustration of this. Each user interest makes its own selection of subject matter, and arranges it according to its own structural pattern. There are as many arrangements of fields as there are interests.

Does this mean that attempts at standardisation must be abandoned? Before so concluding, let us consider more closely the alternative approach that has been adopted by the makers of both special classifications and thesauri designed for detailed indexing rather than arrangement . Each indexing aid, in effect, defines a field not in respect to its position in a wider universe, but by enumeration of its content. In special classifications for indexing, the field embraced can typically be expressed in a "thing-process" phrase, such as "diamond technology", "food science", "container manufacture" and so on. In each case, an enumerable group of things is selected, and from the many relations in which they subsist (their properties, processes, operations, behaviour, activities) a certain number is selected and enumerated. Every such selection can be the "field" of a classified index (ref. 26). If we examine a thesaurus such as TEST (ref. 13), we again find subject category fields defined by the terms that they include. In both cases, the term content of the field is structured hierarchically. Higher level relations between fields may not be displayed.

Essentially, therefore, both types of indexing aid contain many low-level hierarchies. Each hierarchy is usually restricted to a homogeneous set of terms - things, or their parts, constituents, structures, properties, actions or processes, or operations on things, or operating agents, and so on - each homogeneous set thus being what is called in classification theory a facet (refs. 2, 26). Facets are the building blocks out of which special classifications and thesauri may be assembled. Each special information aid may bring together a different set of facets, and arrange them in a different pattern, but the same facet may be common to many fields, and arrangement within the facet may be the same in each field. It is at this level that standardisation may be possible.

D.6 Recent work on faceted classification

In our descriptions of general classifications (section B2), the occurrence of well-defined facets within each was noted. They are distinctively coded in the UDC, which was the first classification to use the technique, but are most clearly and consciously used by Colon, whose maker Ranganathan introduced the term into classification. "Facet analysis" is now an accepted part of classification theory. Many special classifications have been devised along these lines (ref. 26). Exploratory work is going on in England towards the development of a new general faceted classification (ref. 27). Parallel ideas have been published by Farradane and colleagues (ref. 28).

Farradane sees information as representable through four basic facets of terms: entities, activities, abstracts and properties. He develops the outline of his scheme as in Table 22 (Appendix 3). Austin appears to be analysing at a more general level. These schemes are still at a preliminary stage, and cannot as yet be clearly related to the possible practical requirements of a world science information system.

It is worth looking in more detail at schemes recently drafted by the Information Division of the American Institute of Physics (ref.29). In a classification for Physics, two facets are recognised: (1) objects, (2) phenomena and associated properties. Each facet is divided into sub-facets, and each of these is fully hierarchical. The main "objects" of interest to Physics are listed as:

Mathematical entities.
Particles, fields, nuclei, atoms, molecules.
Chemical elements and their compounds.
Ensembles and aggregate matter.
Astro- and geo-physical objects.
Organisms, biological systems, organs.
Artifacts, devices, instruments, systems.

The "phenomena and properties" listed are those associated with each "object" sub-facet - mathematics, particles, fields, chemicals, ensembles and so on. In illustration, Table 23 (Appendix 3) outlines the whole of each facet, and Table 24 lists Ensembles and their associated phenomena.

In a classification for Chemical physics also drafted at the A.I.P. (ref. 29) there is a shorter list of objects, a long list of "properties, processes and phenomena", and a list of "methods". These lists are divided into small groups, which may or may not be hierarchical. Arrays are usually in alphabetical sequence. An outline of the "properties" facet is presented in Table 25, and a detailed extract in Table 26.

As can be seen, in both these classifications there is no attempt to define and arrange "fields" of Physics. There is a strict concentration on homogeneous facets - objects, phenomena, methods - in each of which hierarchy is introduced to a greater or lesser extent. The "sense-perception" disciplines of physics figure only as phenomenological qualifiers (Ensemble class 47 in Table 24), or as phenomena associated with physical ensembles and chemico-physical objects.

The possibility raised at the end of section D5 is that schedules of this kind - unit facets of objects, properties, processes, methods and so on in different fields of science and technology - might well be standardised for use in intermediate documents and information aids. Similar hierarchies already exist in thesauri such as TEST (compare Table 26 with the list of thermodynamic and thermal properties in Table 14). There seems little point in each intermediate document producing its own variant hierarchy for a unit facet.

The comparisons reported in section C suggest that none of the general classifications considered could provide the necessary standard schedules. The facets of Colon are wholly inadequate in detail, although piecemeal expansion of small areas of technology is now taking place (ref. 30). There are many well-defined facets in UDC, but the frequency of scatter noted in section C2 suggests that there is still much inhomogeneity in its hierarchies, and at best we see UDC as a quarry. To create a standard, much work along lines considered in this section would be needed (ref. 31).

D.7 Conclusion

In placing a contract for a comparative study of classifications, the International Council of Scientific Unions expressed the hope that the results would provide information that would assist in examining: "(i) the possibility of transfer of information between services using different classification systems, and (ii) the necessity for all information services to convert to a unique classification system".

This survey has indicated that, although formal classification schemes do not occur in all intermediate documents in science, the use of classificatory relations for both arrangement and information retrieval is widespread. Equally it has indicated that there is great diversity among the classifications used.

How does this affect the transfer of information between systems? We are saying, in effect, that there is a strong likelihood that the hierarchical relations of any particular topic will be different in each system. These relations are expressible in codes. The only way to get an item coded 541.34 in one system into the coding CDV, or E:22, or F1a10, or 541.8 of another system, is to recode it in each case. This could be done in advance, by compiling an (exhaustive?) list of all topics to be covered by the co-operating systems, and establishing a concordance of codes (our tables provide small samples of this). Whether this task is worth doing will depend upon the function that such transfer of information is intended to perform - a matter yet to be established in the UNISIST study.

An inconclusive answer must also be given to the second point raised by ICSU - whether it is necessary for all information services to convert to a unique classification system. The present diversity strongly suggests that, if interchange between systems is going to be important, then the use of a standard structure for arrangement and indexing is likely to be a better solution than a concordance between divergent structures. As already stated, we do not believe that any of the general classifications examined would be an adequate standard either for arrangement or for indexing. But the kind of classificatory structure needed can only be determined when the function of information transfer between systems has been settled.

Our final conclusions, therefore, can be expressed as follows: Classification has a definite role to play in science information, both in the arrangement of subject representations, and in their detailed indexing. To the extent that the present variety of science information aids are to be integrated, the need for standard classificatory relations will increase. The form of such a standard, and the level at which standardisation should be applied (fields, facets, hierarchies, terms, codes), can only be determined when the mode of integration has been chosen. It is unlikely that any existing classification could be adopted as a standard, but both general and special schemes will be useful quarries from which classificatory relations could be drawn.

E. REFERENCES

(1) Principles by which the fields of science may be arranged in sequence were discussed extensively by H.E. Bliss ("The organisation of knowledge and the system of the sciences", New York 1929, and "The organisation of knowledge in libraries and the subject approach to books", 2nd ed., New York 1939). More recently, principles based on the theory of integrative levels have been advanced - see, for example, D.J. Foskett in "Essays in librarianship in memory of W.C.B. Sayers", London 1961.

(2) Principles by which fields may be divided into facets, and by which terms may be arranged in arrays, have been extensively discussed by S.R. Ranganathan, and conveniently summarised in his "Prolegomena to library classification", 3rd ed., London 1967.

(3) G.A. Lloyd, "The UDC in its international aspects", Aslib Proceedings, vol. 21, No.5, pp. 204-8, 1969.

(4) Sources on the history of classification include W.C. Berwick Sayers "Manual of book classification", 3rd ed., London 1955; E.I. Shamurin "Ocherki po istorii bibliotechno-bibliograficheskoi klassifikatsii", Moscow 1955-59, translated as "Geschichte der bibliographischer Klassifikation", Band 1-2, Leipzig 1964-67; E. de Grolier "Theorie et pratique des classifications documentaires", Paris 1956; M.F. Tauber and E. Wise "Classification systems" (State of the Library Art, vol.1, part 3, New Brunswick 1961); B.C. Vickery "Classification and indexing in science", 2nd ed., London 1959; and the writings of Bliss cited in reference 1.

(5) The edition used was the "Dewey decimal classification and relative index", 17th ed., vols.1-2, New York 1965-67.

(6) The UDC is a multilingual scheme, and the full edition has been published at various levels of completeness in different languages. The present state of publication is summarised in Appendix 4. We have used Englsh versions published by the British Standards Institution, sometimes supplemented by German versions. Since no one language version is complete, and alphabetic indexes are

inadequate, classifying over a wide field of science proved difficult, and we have probably overlooked the existence of terms that are somewhere in the UDC schedules.

(7) H.E. Bliss "A bibliographic classification", vols.1-4, New York 1952-53.

(8) S.R. Ranganathan "Colon classification", 6th ed., Asia Publishing House, 1960.

(9) F. Kutter "Koordinierte Klassifikation", Thalwil-Zurich 1951.

(10) H. Clavier "Nouvelle classification universelle, maitre plan" The author, 1967.

(11) See for example the U.S. Special Libraries Association bibliography "Selected materials in classification", New York 1968.

(12) A list of thesauri currently available at Aslib has been compiled, for inclusion in a forthcoming publication.

(13) "Thesaurus of engineering and scientific terms", issued simultaneously by the U.S. Department of Defence (as report AD 672000) and the Engineers Joint Council, 1967.

(14) U.S. National Library of Medicine "Medical subject headings", Washington 1968.

(15) European Atomic Energy Community "Euratom thesaurus", 2nd ed., Luxembourg 1967.

(16) For example, the International Institute of Welding "Concordance between the classification systems of the IIW and UDC", Paris 1960. An earlier more general and more historical study was that of G. Lorphèvre "La concordance entre classifications", Revue de la Documentation, vol.16, pp.8-16, 1949. G.A. Lloyd has made a "Comparison of Dewey and UDC at a minimum 3-figure level", FID publication 329, The Hague 1960.

(17) An American study is that of J. Pettee "Subject headings: history and theory", New York 1946. A vigorous exploration of

the potentialities of alphabetical sequence is provided by J. Metcalfe "Information indexing and subject cataloging", New York 1957.

(18) C.A. Cutter "Rules for a dictionary catalog", Washington 1876.

(19) B.C. Vickery "Thesaurus - a new word in documentation", J. Documentation, vol.16, pp.181-9, 1960.

(20) International Federation for Documentation "UDC special subject edition for nuclear science and technology", The Hague 1964.

(21) B.C. Vickery "The classification of chemical substances: an historical survey", in D.J. Foskett and B.I. Palmer (ed.) "Essays in librarianship in memory of W.C.B. Sayers", London 1961.

(22) U.S. Federal Council for Science and Technology "COSATI subject category list", Washington 1964.

(23) B.C. Vickery, loc.cit. in ref.4, pp.158-94 on "Historical aspects of the classification of science".

(24) E. de Grolier "A study of general categories applicable to classification and coding in documentation", Unesco, Paris 1962 (French edition 1960).

(25) "Proceedings of the international symposium on relational factors in classification", Information Storage and Retrieval, vol.3, No.4, pp. 177-410, 1967.

(26) B.C. Vickery "Faceted classification", London, revised reprint 1968.

(27) A first brief public report is that of D. Austin, "The new general faceted classification", Catalogue and Index, No.14, pp.11-13, April 1969.

(28) J.E.L. Farradane and others "Research on information retrieval by relational indexing, Part 1, Methodology", City University, London 1966.

(29) For example, R.G. Lerner "Development of a multi-co-ordinate vocabulary: chemical physics" (March 1968); Information Division

"Draft classification scheme for physics" (November 1968) - both reports issued by the American Institute of Physics, New York.

(30) Illustrations of Colon expansions will be found, for example, in Documentation Research and Training Centre, annual seminars 2-5, 1964-67, published by the Indian Statistical Institute, Bangalore.

(31) We would like to draw attention to the forthcoming compilation by Jean Aitchison and others "The English Electric thesaurofacet", Leicester 1969 - a thesaurus integrated with a faceted classification, covering large areas of science and technology, with over 16,000 indexing terms.

(32) P. Auger "Current trends in scientific research", Unesco, Paris 1961.

Appendix 1: Guides used to identify intermediate documents

(a) A.J. Walford (ed) "Guide to reference material, vol 1, Science and Technology", 2nd ed, London 1966.

(b) M.J. Fowler "Guides to scientific periodicals: annotated bibliography", London 1966.

(c) NATIONAL FEDERATION OF SCIENCE ABSTRACTING AND INDEXING SERVICES "A guide to the world's abstracting and indexing services in science and technology". Washington 1963.

(d) H.R. Malinowsky "Science and engineering reference sources", Rochester 1967

(e) L.N. Malclès "Sources du travail bibliographique, tome III, Sciences exactes et techniques", Geneva and Paris 1958

(f) W. Totok and R. Weitzel "Handbuch der bibliographischen Nachschlagewerke", 2nd ed, Frankfurt 1959.

Appendix 2:

COSATI subject category list (all fields, selected groups)

			Dewey	UDC	Bliss	Colon
01		Aeronautics (5 groups)	629.13	629.13	BT	D53
02		Agriculture (6 groups)	630	63	UA	J+KZ
03		Astronomy and astrophysics	520	52	D/DF	B9
	A	Astronomy	520	52	D/DF	B9
	B	Astrophysics	523.013	523.03	DD	B9:6
	C	Celestial mechanics	521.1	521.1	DCC	B9:7
04		Atmospheric sciences	551.5	551.5	DS	U28
	A	Atmospheric physics	551.5	551.51	DSB	U286
	B	Meteorology	<551.5	<551.5	<DS	U28
05		Behavioral and social sciences (11 groups)	150 + 300	159.9 + 3	I + K	S+E
06		Biological and medical sciences, including	570/590 +610	57/59 +61	E/H	G+L
	A	Biochemistry	574.192	577.1	EH	EgG
	B	Bioengineering	-	-	-	-
	C	Biology	570	57	E	G
	D	Bionics	-	-	-	-
	M	Microbiology	576	576.8	FV	G91
	P	Physiology	574.1	576.2	EJ	G:3
	R	Radiobiology	574.1915	<577.3	EAI	G:33C5
07		Chemistry	540	54	C	E
	A	Chemical engineering	660.2	66.0	CTE	F
	B	Inorganic c.	546	546	CI	EI
	C	Organic c.	547	547	CO	E5
	D	Physical c.	541	541	CB	E:2
	E	Radio and radiation c.	541.38	541.15 +541.28	CFD	E:296
08		Earth sciences and oceanography	550	55	DF/D	-
	A	Biological oceanography	574.92	57(26)	EMT	G9555
	B	Cartography	526.8	528.9	DQL	U11
	C	Dynamic oceanography	551.46	551.465	DRS	U256
	D	Geochemistry	551.9	550.4	DHC	
	E	Geodesy	526	528	DQB	U18
	F	Geography	910.2	911.2	DR	U
	G	Geology and mineralogy	549/550	55+549	DG+CH	H
	H	Hydrology and liminology	551.48/49	551.48	DRH	H422
	I	Mining engineering	622	622	UDD	HZ
	J	Physical oceanography	551.46	<551.46	<DRS	<U25
	K	Seismology	551.22	550.34	DHK	H413
	L	Snow, ice and permafrost	<551	551.32/ .34	<DR	H421
	M	Soil mechanics	624.151	624.131	-	-
	N	Terrestrial magnetism	538.7	550.38	DHW	C75
09		Electronics and electrical engineering including	621.3	621.3	BME	D65/66
	B	Computers	621.38195	681.14	AMU	D65,8(B)
	D	Information theory	001.539	621.391	-	-
10		Energy conversion (3 groups)	<621	<621	<UE	D6,3
11		Materials (12 groups)	660/670	66/67	-	F
12		Mathematical sciences	510	51	AM	B
	A	Mathematics and statistics	510	51	AM	B
	B	Operations research	001.424	519.28	-	-
13		Mechanical, etc. engineering (13 groups)	620	62	UO	D6

Continued overleaf

Appendix 2: (continued)			Dewey	UDC	Bliss	Colon
14		Methods and equipment (5 groups)	-	-	-	-
15		Military sciences (7 groups)	355	355	RMB	MV41
16		Missile technology (4 groups)	623.451	623.451.8	-	-
17		Navigation, etc (10 groups)				
18		Nuclear science and Technology, including	621.48	621.039	BEH	-
	B	Isotopes	539.74	621.039.3	CCQ	E196
	H	Radioactivity	539.752	539.16	BF	CM96
	K	Reactor physics	539.75/.76	621.039.51	-	D7
19		Ordnance (8 groups)	623.4	623.4	RMG	-
20		Physics	530	53	B	C
	A	Acoustics	534	534	BP	C3
	B	Crystallography	548	548	CH	H1:8
	C	Electricity and magnetism	537/538	537/538	BJ	C6/7
	D	Fluid mechanics	532	532	BQ	B75
	E	Masers and lasers	537.5+535.58		-	-
	F	Optics	535	535	BI	C51
	G	Particle accelerators	539.73	621.384.6	BEO	-
	H	Particle physics	539.721	539.12	-	C9B
	I	Plasma physics	537.16	533.9	-	-
	J	Quantum theory	530.12	530.145	BFJ	CNI
		Solid mechanics	531	531	BG	C21
	L	Solid-state physics	530.41	539.2	-	-
	M	Thermodynamics	536.7	536.7	BHB	C4:7
	N	Wave propagation	537.12	538.56	BLR	C5:2
21		Propulsion and fuels (9 groups)	629.42	629.1.03<U		D5,7
22		Space technology (4 groups)	629.46/.47	629.19	-	D58

Appendix 3: Tabulations

In Tables 3 to 12 we give some examples of class codes in various classifications to schedules taken from Bulletin signalétique and elsewhere. Gaps may mean the genuine absence of a code for a particular subject, or a failure to discover the appropriate code.

In all codes we have used the stroke (/) to mean "all intervening codes" (thus AM/AY means "all codes from AM to AY inclusive"); the plus (+) to mean "and"; and "less than" (<) to mean "included in" (Thus < 523.85 means that the subject classed is included in the class represented by code 523.85). In Colon, the symbol 0 has been used in an unorthodox way as a generalised link between fields (thus GOC = G related to C = Biology related to Physics = Biophysics).

In all columns headed by an asterisk (e.g. Ref.Zh.*) the notation used is our own, constructed so as to display the hierarchy of the classification. Thus in Table 3, for RZ, B6c Clusters is an entity in the class B6 Stars, and this in turn lies in class B Astronomy; the sequence of classes into which Astronomy is divided is shown by the codes B1, B2, B3, etc.

In Table 13 we compare eight classifications of General and physical chemistry.

In Tables 14 to 18 we report the results of assigning class, codes to terms in thesauri, giving samples and summaries. Tables 19 to 21 compare hierarchies in TEST and MESH.

Finally, Tables 22 to 27 give samples of recent faceted classifications.

Table 3

Bulletin signalétique - second level heading.

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	Cosati
110		Mathematics	A	510	51	AM/AY	B	12A
	I	History	A1	510.9	51(09)	AM3	Bv	-
	II	Logic, axioms	A2	510.1	16	AMA/AMB	R1	-
	III	Groups	A4	512.86	519.4	AQG	B27	-
	IV	Arithmetic	-	511	511	AN	B1	-
	V	Algebra	A4	512	512	AO/AQ	B2	-
	VI	Topology	A5	513.83	513.83	ATQ	B316	-
	VII	Analysis	A7	-	517	AR	B3	-
	VIII	Geometry	A6	513/516	513/516	AT/AV	B6	-
	IX	Numerical analysis	A7g	517.6	518	AOD	-	-
	X	Information,	-	029.7	002	-	-	05B
		documentation			+			+
		computers	-	510.78	518.5	-	-	09B
	XI	Probability and statistics	A8	519	519.2	AY	B28	-
	XII	Teaching, recreation	A1	510.07	51:37	AMD	BOT	-
120		Astronomy	B	520	521/526	D/DF	B9	03
	I	History	B1	520.9	52(09)	D3	B9v	-
	II	Spherical a	B3c	522.7	522.7	DA	B9:5	-
	III	Theoretical a	B2	521	521	DC	B9:7	-
	IV	Theoretical astrophysics	B5	523.013	523.03	DDB	B9:6	03B
	V	Instruments, techniques	B11	522	52.08	DB	-	-
	VI	Sun	B8	523.7	523.7	DE	B93	-
	VII	Solar system	B9	523.2	523.2	DF	B94	-
	VIII	Stars	B6	523.8	523.8	DD	B96	-
	IX	Clusters	B6c	523.85	523.85	DDU	B963	-
	X	Galaxies	B6e	523.112	523.85	DDV	B964	-
120a		Physics of earth	C	551	550/[illegible]	D	U2	08
	I/II	General				DG		
	III	Terrestrial globe	C4	551	551	DH	U21	08F
	IV	Glaciology	C3c	551.31	551.32	DRD	H421	08L
	V	Oceanography	C3a	551.46/.47	551.46	DRS	U25	08A+C+J
	VI	Atmosphere	-	551.5	551.51	DS	-	04A
	VII	Meteorology	C2	551.5/.6	551.5	DS	U28	04B

Continued overleaf

Table 3

Table 3(continued)

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	COSATI
	VIII	Upper atmosphere and ionosphere	Cla	551.514	551.510.5	DSP	U294+296	-
	IX	Geomagnetism	C1	538.7	550.38	DHW	C75	08N
130		Physics I	E	530	53	B	C	<20
	A	General	E	530.1	530.1	B	C	<20
	B	Mathematical physics	-	530.15	-	BAM	B8	-
	C	Mechanics	D	531	531/533	BC/BD	B7	20D+K
	D	Acoustics	E7c	534	534	BP	C3	20A
	E	Optics	<E5	535	535	BI	C5	20F
	F	Heat, thermodynamics	<E	536	536	BH	C4	20M
140		Electricity	<E	537	537/538	BJ/BL	C6	20C+09
150		Nuclear physics	E3	539.7	<539.1	<BE	C9B3	20G/I+18
160		Structure of matter	E5+6	539.1	<539	BE	C2	-
	A	Condensed state	<E6	-	<539	-	<C2	20L
	B	Atomic and molecular physics	E5	<539.1	539.18/19	<BE	<C9A	-
	C	Spectroscopy	E5c	535.84	535.33	BFN	C5:3	-
161		Crystallography	Fla3	548	548	<CH	H1:8	20B
170		Chemistry	F	540	54	C	E	07
	A	General and physical	F1	541	541	CA/CF	E:1+2	07D
	B	Inorganic	-	546	546	CI/CN	E1	07B
	C	Analytical	F2	543/545	543	CG	E:3	-
	D	Organic	F3	547	547	CO/CR	E5	07C
210		Earth sciences I	<G	549+550	<549+55	<D	<H	<08
	A	Mineralogy	G4b	549	549	CH	H1	08G
	B	Geochemistry	G4a	551.9	550.4	DHC	-	08D
	C	Carbon dating	-	<551.701	550.93	-	-	-
	D	Cosmic chemistry	-	-	523.04	-	B9:68	-
	E	Crystalline rocks	-	-	-	-	-	-
	F	Sedimentary rocks	-	552.5	552.5	DNJ	H23	-

Continued overleaf

Table 3 (continued)

Table 3 (continued)

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	COSATI
214		Applied geology	<G	553	553	DO	H7	-
	A	Economic minerals	G5+6+7	<553	<553	<DO	<H7	-
	B	Mining	-	622	622	UD	HZ	08I
	C	Applied Geophysics	G8c	622.15	<550.8	<DH	-	-
	D	Hydrogeology	G10a	-	551.48	<DR	H422	08H
	E	Engineering geology	G10b	-	<550.8	-	-	-
216		Earth sciences III	G	<550+560	<55+56	<D	<H	08G
	A	Structural geology	G1b	551.8	551.2	<DH	H3	-
	B	Regional geology	G1d	554/559	<55	DL	<H	-
	C	Palaeontology	G2b	560	56	EP	H6	-
320		Biological sciences I	H	<570	577/578	<E	G	<06
	A	Biochemistry	H	574.192	577.1	EH/EI	E9G	06A
	B	Biophysics	I2	574.191	577.3	EA	GOC	-
	C	Biological analysis	-	-	578	EB	-	-
	D	Biological and medical engineering	-	-	-	-	-	06B
360		Zoology	<I	590	59	G	K	<06C
	A	Animal biology	<I	591	591	GA/GI	<K	-
	B	Protozoa and invertebrates	I6b	592/595	592/595	GL/GT	K1/8	-
	C	Vertebrates	I8	596/599	596/599	GT/GY	K9	-
	D	Vitamins growth factors	H4	574.1926	591.13	GLP/GDQ	E97	-
361		Reproduction, etc.	<I	<574/575	<575/577	<GE	K:6	<06P
	A	Sexual reproduction	I12j	574.166	577.8	GEO	K:675	-
	B	Hormones, endocrinology	-	574.1927	577.17	GEK/GEL	E986	-
	C	Genetics	I1c	575.1	575	EN	K:6	-
370		Botany	I4+5	580	58	F	I	<06C
	I	General	I4	581	581	FA	I	
	II	Cytology	I1b3	581.87	576.3	EC	I,11	-
	III	Morphology	-	581.4	581.4	FA+FC	I,1	-
	IV	Physiology	I5	581.1	581.1	FD/FE	I:3	-
	V	Reproduction	<I4	581.3	581.16	FER/FEU	I:67	-
	VI	Embryology	I5g	581.33	581.3	FDI	I:7	-
	VII	Parasitism and symbiosis	-	581.55	576.6	<FF	I:56	-

Continued overleaf

Table 3 (conti. ued)

Table 3 (continued)

		Ref.Zh.*	Dewey	UDC	Bliss	Colon	COSATI
VIII	Evolution	Id	581.38	576.1	EO	I:66	-
IX	Ecology	-	581.5	581.5	FF	I:5	-
740	Metals	J	669	669	CK	E191	11F
I	General	J1	669.0	669.01	CK	E191	
II	Metal physics	E6c	669.9	669.017	CKB/CKG	E1910C21	11F
III	Crystalline structure	E6c7	669.95	548	CKC	E1910C21:8	-
IV	Lattice defects	-	-	548.4	-	-	-
V	Microstructure	-	-	-	CKD	-	-
VI	Equilibria	J7a1	-	669.018.4	-	-	-
VII	Properties, tests	J7b,c	-	669.018	CKE	E1910C	-
VIII/IX	Metallurgical processes	J2+3+4	<669	669.04/.09	CKJ/CKO	-	-
X	Mineral processing	<J3+4	622.7	622.7	CKQ	-	-
XI/XII	Refining	<J2+3+4	<669	669.054	<CK	-	-
XIII	Foundrywork	<J2+3+4	671.2	621.74	URE	-	-
XIV	Powders and wires	<J4+5	671.37	621.76	-	-	-
XV	Analysis and control	J8	669.92	669.9	CKT	E191:893	-
XVI	Heat treatment	J7d	671.36	621.78	<CKL	-	-
XVII	Metal working	J5+6	671.3	621.77	<CKL	-	-
XVIII	Corrosion, protection	-	620.162	620.19	CKI	E191:895	-
XIX	Use of metals	-	-	669.004	-	-	-
	Caps	21	12	4	12	21	70
	Inversions	31	28	34	30	28	
	Multiple codings	0	0	2	1	1	2
	111 BS classes						

Table 3 (continued)

Bulletin signalétique - 120 Astronomy and astrophysics

Table 4

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	Astro.Jb.
120		Astronomy and astrophysics	B	520	52	D/DF	B9	-
I		General	B1	520.1		D	-	I/II
II		Spherical	B3c	522.7	522.7	DAO	B9:5	
	1	Celestial spheres and coordinates	-	522.71	522.71	DAT	B9:51	
	2	Fundamental constants	-	-	-	-	B9:62	IV33
	3	Rotation of earth	B3b	525.35	525.35	DAP	-	IV38
	4	Astronomical time	-	529	529	DBH	B9:1	IV35
III		Theoretical	B2	521	521	DC	B9:7	V
	1	Celestial mechanics	B2a	<521	521.1	DCC	<B9:7	V41
	2	Shape and rotation of bodies	B2d	-	521.14	DCN	B9:76	
	3	Determination of orbits	B2b	<521.3	521.3	DCD	B9:72	V42
	4	Cosmology and relativity	<B10	523.1	523.1	DDD	<CN	V44
	5	Cosmogony	<B10	523.12	523.12	DDC	B9:8	V55
	6	Movement of bodies	B2c	521.13	521.12	DCF	-	V43
IV		Theoretical astrophysics	B5	523.013	521.03	<DD	<B9:6	VI
	1	Fluid mechanics	-	-	521.032	DCR	B9:0C25	
	2	Internal structure	B5b	523.86	521.04	-	B9:68	V54
	3	Atmospheres	B5a	-	-	DD,J	B9:6358	V53
	4	Spectroscopy	-	522.67	521.035	DDL	B9:653	
	5	Statistical methods	-	-	523.802	DDS	B90B28	
	6	Radio astronomy (theory)	-	<523.016	523.162	-	B9:95	
V		Instruments and techniques	B3c+11	<522	<522	DB	-	III
VI	+	Sun	B8	523.7	523.7	DE	B93	VII
	1	Astrometric observations	B8a	-	-	DE8	B93:6	<VII61
	2	Constants and rotation	-	523.71	523.71/73	DE,F	B93:62/63	<VII61

Continued overleaf

Table 4

Table 4 (continued)

			Ref.Zh*	Dewey	UDC	Bliss	Colon	Astro.Jb.
	3	Photosphere	<B8b	-	523.741	DEP	<B93:6358	VII64
	4	Chromatosphere	<B8b	<523.75	523.752	DER	<B93:6358	VII66
	5	Corona	B8c	<523.75	523.755	DET	<B93:6358	VII67
	6	Radiostronomy	B7a	<523.016	523.7:523.162	-	B93:95	
	7	Activity cycle	B8e	-	523.745	-		
	8	Relation to earth	B8d	523.73	-	-	-	
	9	Internal structure	-	523.76	523.76	DEB	B93:68	VII62
	10	Eclipses	-	523.78	523.78	DEW	B93:57	
VII		Planets and solar system	B9	523.2/6	523.2/6	DF	B94/95	VIII/X
VIII		Stars	B6	523.8	523.8	<DD	B96	XI/XIII
	1	Catalogues	B6a	523.8908	523.89	DDH	-	IV32
	2	Movement	-	523.83	523.83	DDP/Q	B96:611	XI 102
	3	Parallax	-	<523.81	523.813	DDJ	B96:522	
	4	Photometry and colorimetry	-	<522.62	523.821	DDK+DDM	B96:64	XI 103
	5	Classification and spectrum	-	523.87	523.87	DDL+DDO	B96:653	XI 104
	6	Atmospheres	-	-	-	DD,J	B96:6358	
	7	Global properties	-	-	-	-	B96:6	XI 105/107
	8	Variables	-	523.844	523.841	DDS	-	XIII
	9	Novae, supernovae	B5c	523.8446	523.841.1	DDT	-	XIII 126
	10	Binaries	B6b	523.841/.843	523.842	<DDR	B962	XII
	11	Pulsating variables	-	-	-	<DDS	-	XIII 122
	12	Eruptive variables	-	-	-	<DDS	-	XIII 124
IX		Clusters	B6c	523.85	523.85	DDU	B964	XV 141/144
X		Galaxies	B6c	523.112	523.855	<DDU	<B964	XV 145
		Gaps		12	8	7	11	
		Inversions		12	11	10	12	
		49 BS classes						

Table 4 (continued)

Bulletin signalétique - 120 a: Physics of earth

			Dewey	UDC	Bliss	Colon
120a		Physics of earth	551	550	DR	U+H4
I/II		General				
III		Terrestrial globe	551.1	525	-	U21
	a	Weighing	<525.1	525.11	DQD	B91:622
	b	Triangulation	526.33	526.3	DQH	U112
	c	Measure of distance	-	526.2	DQG	U114
	d	Levelling	526.36	526.95	DQH	D:21
	e	Shape of the earth	<525.1	526.1	DFT,H	B91:621
	f	Cartography	526.8	526.8	DQL	U11
	g	Aerial photography	526.9823	526.9185	-	D:28
	h	Photogrammetry	526.982	526.918	AWV	-
	i	Internal composition	551.11	551.1	DHE	B91:68
	j	Geothermy	<551.12	550.836	DFT,N	-
	k	Radioactivity	<525.2	550.378	-	-
	l	Vulcanology	551.21	551.21	DHG	H411
	m	Slow crust movements	<551.14	<551.14	-	H413
	n	Seismology	551.22	550.34	DHK	H4132
	o	Geophysical observations	<551	550.3	-	-
IV		Glaciology	551.31	551.32	DRD	H421
	a	Ice	551.31/34	<551.32	<DRY	-
	b	Glaciers	551.31	551.324	DRG	-
	c	snow	-	<551.322	-	-
	d	icebergs	551.342	551.326	-	-
V		Oceanography	551.46/47	551.46	DRS	U25
	a	Bathymetry, ridges	<551.46084	551.462	<DRS	-
	b	Sea floor and shore	<551.46084	551.462	DRU	U253
	c	Sea water	551.4601	551.463	-	U255
	d	Ocean level	-	551.461.2	-	U252
	e	Currents	551.4701	551 465	<DRT	U2562
	f	Tides	551.4708	525.6	<DRT	-
	g	Swell	-	-	-	-
	h	Internal waves etc.	<551.4702	-	-	-
	i	Technique	-	551.46.018	-	-

Continued overleaf

Table 5

Table 5 (continued)

		Dewey	UDC	Bliss	Colon
VI	Atmosphere	551.5	551.5	<DS	U28
a	Composition	551.511	551.510.4	DSC	U2863
b	Water vapour	551.571	551.57	DSL	U285
c	Radioactivity	-	551.510.7	-	-
d	Air masses	551.5512	551.515.8	-	-
e	Pressure	551.54	551.54	DSE	U282
f	Temperature	551.525	551.524	DSF	U284
g	Acoustics	-	551.596	-	U2862C3
h	Actinometry	-	551.521.12	DSG	-
i	Radiation	551.527	551.521	<DSG	U2862C5
j	Optics	551.565/.567	551.593	DSQ	U2862C51
k	Electricity	551.561/.564	551.594	DSY	U2862C6
l	Troposphere	551.513	551.510.52	<DSH	-
m	Dynamics	551.5153	551.511	DSH	-
n	Air circulation	551.517	551.513	<DSH	-
o	Winds	551.518	551.55	DSI	U283
p	Cyclonic perturbations	551.552	551.515.2	DSJ	-
q	Fronts	551.5512	<551.515.8	-	-
r	Tornadoes, storms	551.553	<551.515	DSK	U22835
s	Turbulence	-	-	-	-
VII	Meteorology	551.	551.5	DS	U28
a/c	Technique	<551.	551.50	DSD	-
d	Forecasting	551.63	551.509	DSU	U2891
e	Clouds	551.576	551.576	<DSM	U2853
f	Precipitation	551.577	551.577	DSN	U2855
g	Agricultural	-	551.5:63	DSV	U280J
h	Climatology	551.62	551.58	DSR	U287
i	Climatic variation	-	551.583	<DSR	-

Continued overleaf

Table 5 (continued)

Table 5 (continued)

			Dewey	UDC	Bliss	Colon
VIII	a	**Upper atmosphere and ionosphere**	551.514	551.510.3	DSP	U29
	b	Density, composition	-	‹551.510.3	-	-
	c	Displacement, turbulence	551.557	-	-	-
	d	Ionisation	551.561	551.594.12	-	-
	e	Electromagnetic waves	-	-	-	-
	f	Magnetic field conductivity, trapped particles	-	551.594.13	-	-
	g	Ionospheric layers	538.767	‹551.510.535	-	-
	h	Ionospheric perturbations	-	-	-	-
	i	Solar eruptions	-	551.590.21	-	-
	j	Polar aurorae	538.768	551.594.5	‹DSY	-
	k	Luminous emissions	-	-	-	-
IX		Geomagnetism	538.7	550.38	DHW	C75
	a	Observations	538.79	550.38[illegible]	‹DHW	-
	b	Distribution	-	550.389	-	-
	c	Magnetism of rocks	549.127	550.382	-	H20C7
	d	Palaeomagnetism, secular variations	‹538.72	550.384.3	‹DHW	-
	e	Periodic variations	538.74	550.384.4	‹DHW	-
	f	Telluric currents	538.748	550.387	-	-
	g	Magnetic perturbations	538.744	550.385/.386	‹DHW	-
		Gaps	18	7	29	40
		Inversions	21	26	13	13
		83 BS classes				

Table 5 (continued)

Table 6

Referativnyi Zhurnal - E Physics

			Bull.sig.	Dewey	UDC	Bliss	Colon	Phys.Abs.	Phys.Ber.
E*		Physics	130/160	530	53	B	C	PA	PB
1		General, methods	130A	-	53.08	BB	-	01.00	I
2		Theoretical	130B	530.1	530.1	BA	C1	02.00	II
	a	Quantum mechanics	130BV	530.123	530.145	BFJ	CNI	10.00	IIa
	b	Statistical physics	130BII	530.13	531.19	BEV	CN2	02.40	IIb
	c	Irreversible processes	130FIII	-	530.161	-	-	-	-
	d	Special relativity	130BIV	<530.11	<530.12	BCL	<CN	02.30	IIc
	e	General relativity	130BIV	<530.11	530.12	BAR	<CN	02.30	IIc
	f	Quantum electrodynamics	140XII	-	535.14	-	C68	-	
	g	Field theory	-	530.14	-	-	-	-	IIc
	h	Elementary particles	150III	539.721	539.12	-	C9B	12.00	V
3		Nuclear physics	150	539.7	539.14/.17	BEH	C9B3	13.00	<V
4		Plasma physics	140XIII	537.16	533.9	-	-	14.60	VIIa
5		Atoms and molecules, etc.	160B	539.1	539.18/.19	<BE	C9B1/2	14.00	VI
	a	Atomic electron shells	160BIIa	539.14	539.184	BED	-	14.20	VIa
	1	Atomic spectra	160BIIa	<539.14	-	-	-	-	-
	2	Electrical, magnetic props.	-	-	-	-	-	-	-
	3	Interatomic forces collisions	-	-	539.186	-	-	-	-
	b	Molecules (subdivide as a)	160BIIb	539.12	539.19	BER	-	14.30	VIb
	c	Spectroscopy	160C	535.84	535.33	BFN	C5:3	<08.35	-
	1	Individual atoms	160CIc	-	<535.33	-	-	-	-
	2	Individual molecules	160CId	-	535.333	-	-	-	-
	3	Intermolecular interactions	-	-	-	-	-	-	-
	4	Plasma, flames	-	-	535.343.1	-	-	-	-
	5	Crystals	-	-	535.343.2	-	-	-	-
	6	Methods	160CIb	-	535.33.03	-	-	08.35	-

Continued overleaf

Table 6 (continued)

				Bull.sig.	Dewey	UDC	Bliss	Colon	Phys.Abs.	Phys.Ber.
	d		Magnetic resonance	-	-	-	-	-	14.32	-
		1	Nuclear	-	-	-	-	-	-	-
		2	Electron	-	-	-	-	-	-	-
	e		Luminiscence	130EIIe	535.35	353.37	BIC	C5:73	17.95	VIII15
	f		Physical optics	130EVI	535.2	<535	<BI	-	08.40	-
	g		Geometrical optics	130EVIII	535.32	535.31	BIK	-	08.20	-
	h		Light sources, etc.	130EVa	-	535.89	BIC	C51:1	-	-
		1	Pyrometry	-	-	536.52	-	-	-	-
		2	Photometry	130EIV	535.22	535.24+.65	BIG	C51:28	08.10	-
	i		Physiological optics	130EIIIa	612.84	535.7	HWB	L185:3	08.60	-
	j		Photography	130EXIV	770	77	CFP	M95	08.50	-
6			Gases, liquids, solids, polymers	130C+160A	530.4	-	BG	C2	15/17	VII/VIII
	a		Gases, vapour, liquids	160AIII	530.42/.43	532/533	BGG	C25/28	15.00	VII
	b		Macromolecular and vitreous	160AIf	-	539.213	-	C215	17.10	-
	c		Solids	130C+160AI	530.41	539.21	<BGP	C21	17.00	VIII
		1	Theory	-	-	-	-	-	-	-
		2	Structure	-	-	<539.2	-	C21,8	17.05	VIII1
		3	Elastic properties	130CV	531.38	539.3	<BGE	C21,2	<17.50	VIII3
		4	Diffusion	-	-	539.378.3	-	C21,93	17.37	-
		5	Phase equilibria	-	-	-	-	-	-	-
		6	Crystallisation and melting		536.42	536.421	BGV	C4:51	17.34	-
		7	Real crystal		548.8	548.7	-	-	17.15	VIII 1
		8	Mechanical properties	130CVI	-	-	BGE	C21:2	17.50	VIII3
		9	Effect of radiation	-	-	-	-	C210C5	17.45	VIII 2
	d		Solid dielectrics and semiconductors			537.311.33				
	e		Solid metals	160AIc	669.9	537.311.31	CK	C21E191	17.61	VIII10
7			Radiophysics, electronics, acoustics	-	-	-	-	-	-	-
	a		Radiophysics	140XIV	537.12	538.56	BLR	C5	07.00	IVg
	b		Physical electronics	140IX+XI	537.5	937.533.7	-	C9B5	<11.00	<IV
	c		Acoustics	130D	534	534	BP	C3	03.30	IIIe
			Gaps		23	13	26	26		
			Inversions		13	15	13	10		
			56 RZ classes							

Table 6 (continued)

Bulletin signalétique - 160: Structure of matter

Table 7

		Ref.Zh.*	Dewey	UDC	Bliss	Colon	Phys.Abs
160	Structure of matter	E5/6	530+539	539	BG	C2	
A	Condensed state		-	-	-	-	
I a	Solids, general	E6c	530.41	539.2/.8	BGP	C21	17.00
b	Superconductivity		537.623	537.312.62	<BKF	-	17.63
c	Magnetism	<E6d/e	538	538.22	BL	C210C7	17.80
d	Semiconductors, dielectrics	E6d	537.24+.622	537.226+.311	BJH	-	17.66+17.69
e	Metals and alloys	E6e	669.9	537.311.31	CKB	-	17.61+17.05
f	Vitreous and amorphous	<E6b	-	539.213	-	C215	17.10
II	Mesomorphic state		-	548-15	BGN	-	
III	Liquids	<E6a	530.42	539.266	BGL	C25	15.50
B	Atomic and molecular physics	E5	539.1	539.18/.19	<BE	-	14.00
I a	Theoretical, general	E5a	-	539.1.01	-		
b	Classical theories		-	-	BEF	-	
c	Quantum theories		530.12	530.145	BFJ	CNI	10.00
d	Electron wave functions		-	-	-	-	
e	Methods of calculation		-	-	-	-	
II	Particular systems						
a	Levels, electron structure and atomic spectra	E5a1	539.14	539.184	BED	-	14.20
b	Ditto, molecular spectra	E5b1	539.12	539.194	BER	-	14.31
c	Molecular assemblies		-	-	-	-	
d	Structural studies	<E5c	-	539.2	-	-	
III	Diffusion and collisions	<E5a/b	-	533.72	-	-	
a	Elastic and inelastic		-	-	-	-	
b	Reactive		-	-	-	-	
c	Ionisation, electron capture		-	-	BEQ	-	14.50
d	Excitation, lifetime		-	539.186+.196	-	-	

Continued overleaf

Table 7 (continued)

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	Phys.Abs.
C		Spectroscopy	E5c		535.33	BFN	E:3E5	08.35
I	a	Structures determined optically				-	-	
	b	Apparatus, techniques	E5c6	535.84	<535.33	BFN	-	
	c	Atomic spectra	E5c1	539.14	<535.33	-	-	
	d	Molecular spectra	E5c2	539.12	<535.33	-	-	14.31
	e	Raman spectra		535.846	-	-	E:3E7	
	f	Electro-magneto-optics		537.56	535.215+ 538.61	BFQ/BFR	C51:38	
	g	Faraday effect, optical rotation		535.524	535.56	BIV	C51:6	
	h	Molecular refraction		<535.324	<535.32	<BFM	C51:23	
II	a	Structures determined by Hertzian waves and multipolar moments		-	-	-	-	07.20
	b	Apparatus, techniques		-	-	-	-	
	c	Magnetic moments		-	535.336.3	-	E:3G	
	d	Electric moments			-	-	E:3F	
	e	Quadrupole moments		-	-	-	-	
	f	Cyclotron resonance		-	-	-	-	
III		Structures determined by Mossbauer effect		-	-	-	-	
IV		Structures determined by mass spectrometry		-	535.336.2	-	E:3T5	14.10
V		Structures determined by mechanical waves	E6c3	-	-	-	-	
	a	Elastic constants		-	-	-	-	
	b	Relaxation time		-	-	-	-	
		Gaps		25	18	26	31	
		Inversion		9	10	7	3	
		46 BS classes						

Table 7 (continued)

Table 8

Physics abstracts - 17. Solid state physics

		Dewey	UDC	Bliss	Colon	Solid State Abs.	Phys.Ber.	Ref.Zh*
17.05	Structure of solids	530.41	539.2	BGP	C21,8			E6c2
06	Phase transformations	-	-	BGW	-	‹A2		E6c5
07	Surfaces	-	539.211	-	C21,4	‹A5+B1	VIII.17	
08	Films	-	539.23	-	-	‹A5+B2	VIII.16	
09	Adsorption	-	-	‹BGQ	-			
10	Non-crystalline state	-	539.213	-	C215			E6b
15	Crystallography	548	548	CHC	H1:8			
20	Microstructure	-	539.24	-	-			
25	Crystal lattice structures	-	548.1	CHH	-	A5	VIII.I	
30	Lattice mechanics	-	-	-	-	C2	VIII.4	
32	Acoustical properties	534.22	539.21:534	‹CHI	C210C3	‹C3		E7c
34	Thermal properties	548.86	539.21:536	‹CHI	C210C4	C4	VIII.5	E6c3+d3+e3
37	Diffusion	‹531.7	539.378.3	‹BGQ	C21,93	A4J		E6c4+d4+e4
40	Defect properties	-	548.4	-	-	A6	VIII.2	E6c7
42	Colour centres	-	539.21:535.21	-	C210C5	‹B3	‹VIII.2	E6c9+d7+e7
45	Radiation effects	-		-				
50	Mechanical properties	548.84	539.3	‹BGQ	C210B7	A7+C3	VIII.3	E6c8+d3+e3
55	Electron states	-	-	-	-	C2b		E6c1+d1+e1

Continued overleaf

Table 8 (continued)

		Dewey	UDC	Bliss	Colon	Solid State Abs.	Phys.Ber.	Ref.Zh*
60	Electrical properties	548.85	539.21:537	CHK	C210C6	C6/8		E6d5+e5
61	Metals, conductors	<548.85	537.311.31	BKF	C210C6:21	C7	VIII.10	F6e5
63	Superconductivity	537.623	537.312.62	<BKF	-	C8	VIII.9	
64	Superconducting materials and devices	-	-	-	-	C8i		
66	Semiconductors	<548.85	537.311.33	-	-	<C7	VIII.II	<E6d
67	Semiconducting materials	-	<537.311.33	-	-			
68	Semiconducting devices	-	621.382	-	-			
69	Dielectrics	<548.85	537.226	BJH	C210C6:211	C6	VIII.6	E6d
70	Thermoelectric properties	537.65	537.323	BKP	C210C6:44	C4e	VIII.12	
73	Photo-conductive,-voltaic effects	537.54	535.215	-	C210C6:45	C5e	VIII.13	
77	Electron and ion emission	537.533	537.58	BKT	C210C6:25	C7e		E7b1
80	Magnetic properties	538	538.22	BLC	C210C7	C9	VIII.7	E6d6+e6
81	Paramagnetic	538.43	538.222	<BLC	C210C73	C9b		
82	Ferromagnetic	538.44	538.221	<BLC	C210C74			
83	Ferrimagnetic	538.45	-	-	-			
84	Antiferromagnetic	-	-	-	-			
85	Magnetic resonances	-	-	-	-	<C1		E5d
90	Optical properties	535.2	539.21:535	<BI	C210C51	C5	VIII.15	E6d5+e5
95	Luminescence	535.35	535.37	BIC	C210C51:73			E5e2
	Gaps	17	9	16	17			
	Inversions	7	10	5	6			

Table 8 (continued)

Bul'etin signalétique - 170 Chemistry, main divisions

		Ref.Zh.*	Dewey	UDC	Bliss	Colon	Chem Abs.	Chem.Zentr.	Curr. Chem.Pap.
170 A	General and physical	Fla	541	541	CA/CF	E:1/2			
I/II	General		-	-	CA	-	65		
III	Determination of atomic and molecular weights		541.222	541.23/24	CCC	E:14			
IV	Structure	Fla1	541.22	541.6	CBD	E:218			2
V	Equilibria	‹Fla7	541.392	541.121	CDD	E:2133	‹68	‹A4	3
VI	Solutions	Fla10	541.34	541.8	CDV	E:22	‹68		
VII	Diffusion		532.7	532.7	-	-			
VIII	Rheology, viscosity, adherence, cohesion		532.58	532.13	BGG	C2,9			
IX	Chemical kinetics	‹Fla8	541.39	541.124	CDE	E:213	‹67	A7+B6	8
X	Catalysis	‹Fla8	541.395	541.128	CDI	E:88	‹67	A7+B6	
XI	Combustion	‹Fla8	541.361	536.46	‹CDG	E:2131			
XII	Termochemistry	‹Fla7	541.36	541.11	CDP	E:24	69	A4+B3	7
XIII	Activity and fugacity		-	-	CDW	-			
XIV	Radiation chemistry	‹Fla9	541.35	541.15	CF	-	74		
XV	Electrochemistry	Fla11	541.37	541.13	CE	E:26	77	A5+B5	6
XVI	Surfaces	Fla12	541.3453	541.183	CDU	E:232	‹66	‹A6	4
XVII	Colloidal and dispersed states	Fla13	541.3451	541.182	CDT	E:235	‹66	‹A6	5
B	Inorganic	Flb	546	546	CI/CN	E1	78		9
I	History and general		546.1	546(09)	CI,3	-			
II	Kinetics and reaction mechanism		‹541.39	546:541.124	‹CD	E1:213		A7	
III	Apparatus		‹542	546:542.2	-	-			
IV	Preparations and properties		‹546	‹546	CI,P	E1:4		A8	

Continued overleaf

Table 9 (continued)

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	Chem.Abs.	Chem.Zentr.	CurrChemPap.
C		Analytical	F2	543/545	543	CG	E:3			
I/IV		General	F2a	<543/545	543.2/.5	CG	-		G1	12a
V		Inorganic	F2b	<543/545	543.7	CI,G	E1:3	79	G2	12b
VI		Organic	F2c	547.3	543.8	CO,G	E5:3	80	G3	12c
D		Organic	F3	547	547	CO/CR	E5	21/30		
I/IV		General	F3a		547.1	CO	-			
V		Preparations and properties		<547	<547	COT			C	
	a	Synthesis	F3b1	547.2	-	COM	E5:4			
	b	Organometallics	F3b6	-	<547	COV	E5191	29		10
	c	Aliphatics	F3b2	547.4	547.2/.4	CPA	E6	23	C1	11a
	d	Benzene compounds	<F3b4	547.611	547.5	CQH	E71	25	<C2	11d
	e	Aromatics condensed	<F3b4	547.615	547.6	CQJ	E7	26	<C2	11d
	f	Cyclanes, terpenes, steroids	F3b3+F3c2	547.5+.7	547.51+ 547.59+ 547.92	CQA+ CRN	E79+996	24+30+32		11e
	g	Heterocyclics	F3b5	547.59	547.7/.8	CR	E8	27/28	C3	11b
	h	Carbohydrates	F3c1	547.78	547.45	CRO	E68	33		11c
	i	Amino-acids and peptides	F3c7	-	547.96	CPM	E92Z	34		11b
		Gaps		4	3	2	9			
		Inversions		13	10	11	8			
		38 BS classes								

Table 10

Bulletin signalètique - 170A: General and physical chemistry

			Ref.Zh.*	Dewey	UDC	Bliss	Colon
170A		General & physical chemistry	Fla	541	541	CA/CF	E:1/2
I		General and history		-	541(09)	CA	-
II		Apparatus & techniques		542	-	CAL	-
III		Determination of atomic and molecular weight		541.222 +225	541.23/.24	CCC	E:14
IV		Chemical structure	Fla1	541.22	541.6	CBD	E:218
V	a	Equilibria	<Fla7	541.392	541.121	CDD	E:2133
	b	Homogeneous		-	541.122	-	-
	c	Heterogeneous		-	541.123	-	-
VI	a	Solutions	Fla10	541.34	541.8	CDV	E:22
	b	Properties		541.341	-	-	-
	c	Solubility curves		541.342	532.739	CCK	E:2201
	d	Dissociation constants		541.3722	541.132	CEH	-
	e	Solvents		541.3482	-	-	-
VII		Diffusion		532.7	532.7	-	-
VIII		Rheology, viscosity, adherence, cohesion		532.58	532.13	BGG	C2,9
IX	a	Chemical kinetics	<Fla8	541.39	541.124	CDE	E:213
	b	Analysis of reactions		-	-	CDG	-
	c	Chain reactions		<541.393	541.124.7	-	-
	d	Reaction rate measurement		541.394	541.127.1	CDH	-
X		Catalysis	<Fla8	541.395	541.128	CDI	E:88
	a	Homo-and hetero-geneous		-	541.128.1	-	-
	b	Catalysts		-	<541.128	-	-
XI		Combustion and flames	<Fla8	541.361	536.46	<CDG	E:2131
	a	Explosions		-	541.126	-	-
	b	Deflagrations		-	-	-	-
	c	Detonations		-	-	-	-
	d	Heats of combustion		541.362	536.662	-	-
XII		Thermochemistry	<Fla7	541.36	541.11	CDP	E:24
	a	Theories					
	b	Thermodynamic properties		<541.369	<536.7	CDN	-
XIII		Activity and fugacity		-	-	CDW	-
XIV	a	Radiation chemistry	<Fla9	541.35	541.15	CF	
	b	Chemical changes		-	-	CFD	-
	c	Chemi-luminescence		-	535.379	-	-
	d	Photochemistry of sensitive layers		-	541.14	CFI	E:25
XV	a	**Electrochemistry**	<Fla11	541.37	541.13	CF	E:26
	b	Electrolytic solutions		541.372	<541.13	CEE	-
	c	Interfaces		-	-	-	-
	d	Electrochemical kinetics		-	-	-	-
	e	Electrodeposition		545.34	621.357.7	-	-
	f	Anodic solution and oxidation		-	<541.138.2	CER	-
	g	Corrosion, cathodic and anodic protection		620.162	<541.138.2	CKI	-
	h	High temperatures		541.3687	541.136.86	CDR	-
	i	Electrochemical generators		621.35	541.136	CEK	-
	j	Surface treatment		-	621.357.8	CKV	-
	k	Electrochemical preparations		-	542.8	CET	E:86

Continued overleaf

Table 10 (continued)

			Ref.Zh.*	Dewey	UDC	Bliss	Colon
XVI	a	Surfaces	Fla12	541.3453	541.183	CDU	E:232
	b	Surface tension and capillarity		<ditto	532.6	BGU	C2,4
	c	Interfaces, liquid gas and liquid-liquid		ditto	532.613.4	-	-
	d	ditto, solid-liquid		ditto	532.613.2	-	-
	e	ditto, solid-gas		ditto	532.613.3	-	-
	f	ion exchange,selective adsorption		541.3723	541.183	-	-
	g	Adsorbents		-	<541.183	-	-
	h	Surface-active substances		668.1	-	-	-
XVII	a	Colloidal and dispersed states	FLa13	541.3451	541.18	CDT	E:235
	b	Apparatus and techniques		-	541.18.05	-	-
	c	Granulometry		-	-	-	-
	d	Physical & chemical studies		-	-	-	-
	e	Micelles		-	-	-	-
	f	Thin films		<541.3453	-	BGU	-
	g	Electrokinetic phenomena		-	-	-	-
	h	Constitution and structure		-	541.18.02	-	-
	i	Emulsions, suspensions, gels,aerosols		<541.3451	541.182	BGR	E:236+238
	j	Porosity		531.7	539.217.1	-	-
	k	Permeability		<532.7	539.217.3	-	-
		Gaps		25	16	30	45
		Inversions		14	19	12	5
		65 BS classes					

Bulletin signalétique - 320/370: Biology, main divisions

Table 11

			Ref.Zh.*	Dewey	UDC	Bliss	Colon	Biol.Abs.*	Ber.ges.Biol.*	Int.Abs.Biol.Sci.*
320		Biochemistry, biophysics etc.		574.19	577/578	-	-			
	A I	Biochemistry	H	574.192	577.1	EH/EE	E9G	14+32	C	C
	II	Chemical constituents		574.1921	577.11	EHF	-			
	III	Body fluids and tissues	I1le/f	-	-	<EHF	-	25		F11
	IV	Enzymes	H3	574.1925	577.15	EIP	E982	16	<D	C6
	V	Metabolism		<574.13	576.343	EJM	G33E		<D	
	B I	Analytical biochemistry		<543/545	578	EHG	E9G:3			C15
	II	Physical methods		543.08	578.088	EHB	E9G:3B			
	III	Chemical methods		-	578.088.1	EHG	E9G:3J			
	IV	Biological methods		-	-	-	E9G:3X			
	C I	Biophysics	I2	<574.191	577.3	EAB	GOC	15+32		
	II	Physical properties		-	-	-	-			
	III	Physical Agents		574.191	-	-	-	10		
	IV	Physical phenomena		-	-	-	-			
	D	Biological and medical engineering		-	-	-	-			
360		Zoology	I6	590	59	G	K			
	A I	Animal biology		591	591	GA/GI	-			
	II	Geographical distribution	I6a4	591.9	591.9	GH	KOU		J	
	III	Ecology	I6a3	591.5	591.5	GG	K:5	<13	I	
	IV	Ethology		-	<591.5	-	-			
	V	Cytology	I1b4	591.8	591.81	EC	G11	<4	H	F1
	VI	Morphology & histology	I6a2	591.4	591.4+8	GA	K:2	17		A
	VII	Embryology	I10b	591.33	591.3	EE	K:7			F3
	B	Protozoa & invertebrates	I6b	592/595	592/595	GL/GT	K1/8	42+43		
	C I	Vertebrates		596/599	596/599	GU/GY	K9	44		
	II	Cellular physiology		574.876<	576.3	ECT	G11:3	<4		
	III	Tissue culture, etc.		636.08	578.085.23	EBC				F4
	IV	Development		591.3	591.3	GDQ	K9:7			
	V	Metabolism	I11c	<591.13	591.133	GDH	K9:33	20	D	F2

Continued overleaf

Table 11 (continued)

		Ref.Zh*	Dewey	UDC	Bliss	Colon	Biol.Abs.*	Ber.ges.Biol.*	Int.Abs.Biol.Sci.*
VI	Nutrition	I11j	<591.13	591.13	GDK	K9:573	21		F6
VII	Respiration	I11i	591.12	591.12	GEE	K9:36	27		F7
VIII	Communication	I12d	591.59	591.58	GFY	-			
IX	Excretion	I11k	591.14	591.149	GEI	K9:35	26		F8
X	Circulation	I11g	591.11	591.112	GEA	G3	24		F9/10
XI	Nervous system	I12a/c	591.48	591.18	GF	G7			F9/10
XII	Integument	I10j	<591.47	<591.47	GEW	G87			
XIII	Skeleton	<I10e	<591.47	591.471.3	GCT	G82	31		
XIV	Muscular system	<I10e	591.47	591.473	GER	G83	30		
XV	Movement		591.18	591.17	GEP	-			
XIV	Applied physiology		-	-	-	-			
D	Vitamins, growth factors	H4a	574.1926	577.16	GDP	E97		<C	C8
	Reproduction, endocrinology, genetics		-	-	-	E:6			
A	Sexual reproduction		574.166	577.8	GEO	G:675	28		F12
B	Hormones	H4b	574.1927	577.17	GEL	E:986	29	<C	C9+F13
C	Genetics	I1c1	575.1	575.1	EN	G:6	5		
370 I	Botany, plant biology	I4	580	580	F	I			
II	Cytology	I1b3	581.8	576.3	EC	G11	<4	<B	E14
III	Morphology and systematics								
IV	Physiology		581.1	581.1	FD/FF	I:3	<32		
V	Reproduction		581.16	581.16	FER	I:67			
VI	Development	I5g	581.3	581.14	FDI	I:7			E8/11
VII	Parasitisin & symbiosis		581.55	581.557	<FF	I:56		<I	
VIII	Evolution	<I1d	581.38	576.12	ENZ	I:66	<3		
IX	Plant and environment		581.5	581.5	FF	I:5			
	Gaps		9	8	9	12			
	Inversions		18	18	20	14			
	54 BS classes								

Table 11 (continued)

Table 12

Bulletin signalétique - 320 A Biochemistry

				Ref.Zh.*	Dewey	UDC	Bliss	Colon
320 A	I		Biochemistry	H	574.192	577.1	EH/EI	E9G
	II		Chemical constituents		574.1921	577.11	EHF	-
		a	Inorganic, mineral		574.19214	:546	EHI	EI
		b	Glucides		-	:547.918	EIR	E6898
		c	Lipoids		574.19293	:547.915	EIT	E96
		d	Steroids, terpenes		-	:547.92	EIU	E996
		e	Protides	H2b	574.19296	:547.96	EID	E92Z
		f	Alkaloids		-	:547.94	EIL	E92
		g	Nucleic acids	H2c	-	-	E11	-
		h	Pigments		574.19297	:547.97	EIV	E95
		i	Natural substances, plant		581.192	:547.992	-	-
		j	ditto, animal		591.192	-	-	-
		k	Vitamins, hormones	H4	574.1926	577.16/.17	E10	E97+986
	III		Body fluids and tissues		-	-	GCW	-
		a	Blood		612.11	612.12	GEB	G35
		b	Urine		612.461	612.46	GEI	G515
		c	Tissues		574.82	576.72	GC	G12
		d	Cellular biochemistry		574.876	576.311.1	ECU	E9G11
	IV	a	Enzymes	H3	574.1925	577.15	EIP	E982
		b	Hydrolases		-	577.152	-	E9822
		c	Oxidases reductases		574.19258	577.158	-	E9821
		d	Desmolases		-	577.158	-	-
		e	Transfer, isomerising and synthesising		-	-	-	-
	V		Metabolism		574.13	591.133	EJM	G:33
		a	Inorganic, mineral		581.1335	591.133	EHJ	G:33E1
		b	Intermediate		-	-	-	-
		c	Glucides		-	-	EIR	G:33E6898
		d	Nitrogen		-	581.133.1	EHL	G:33E150
		e	Lipids and steroids		581.13346	-	EIT/EIU	G:33E96+996
		f	Other plant substances		-	-	-	-
		g	Photosynthesis		581.13342	581.132	EAJ	G:33E981
			Gaps		12	7	8	8
			Inversions		5	6	8	6
			31 BS classes					

Classifications of general and physical chemistry (see also the Bulletin signalétique classification in Table 8)

Table 13

Chem.abs.

65	General phys. chem.
66	Surface chem., colloids
67	Catalysis, reaction kinetics
68	Equilibria, solutions
69	Thermo-dynamics, - chem.
70	Crystallisation and crystal structure
71	Electric phenomena
72	Magnetic phenomena
73	Spectra, optical props.
74	Radiation and photochem.
75	Nuclear phenomena
76	Nuclear technology
77	Electrochem.

Chem.zentr.

A	General, physical inorganic chem.
A1	Atomic nuclei
A2	Atoms, molecules
A3	Solids, liquids
A4	Thermodynamics, equilibrium gases, liquids
A5	Electrochem
A6	Colloid chem, interfaces
A7	Kinetics, catalysis
B	Physical organic chem.
B1	Optical, electric, magnetic props, spectra
B2	Structure determination
B3	Thermodynamics
B4	Equilibria
B5	Electrochem.
B6	Kinetics, catalysis

Ref.zh.*

0	General
1	Theory of molecular structure and chemical bonding
2	Experimental structure determination
3	Crystal chem. and crystallography
4	Chem. of solids
5	Gases, liquids, amorphous
6	Radiochem., isotopes
7	Thermo-dynamics, -chem, equilibria
8	Kinetics, combustion, explosions, topochem, catalysis
9	Photo-, radiation and plasma chem.
10	Solutions, acids and bases
11	Electrochem.
12	Surface chem.
13	Colloid chem.

Curr.chem.pap.

1	Subatomics
2	Atomic and molecular structure
3	Phases
4	Surface props
5	Colloids and macromolecules
6	Electrochem.
7	Thermodynamics
8	Kinetics, mechanism

Dewey

541.2	Theoretical chem.
.22	Molecular structure
.24	Atomic structure
.26	Stoichiometry
.28	Quantum chem.
.3	Physical chem.
.34	Solutions, colloids
.35	Photochem
.36	Thermo-chem,-dynamics
.37	Electro-magneto-chem
.38	Radiochem.
.39	Kinetics, mechanism
.7	Optical activity

Bliss

CB	Physical chem.
D	Chem. constitution
E	Constitution and props.
G	Stereochem.
J	Chem. combination
O	Isomerism, etc
S	Adsorption
T	Polarization
CC	Stoichiometry
C/G	Atomic, molec. weights
H/J	Thermal props.
K	Solubilities

Continued overleaf

Table 13 (continued)

UDC

541.1	Physical chem.
.11	Thermochem,-dynamics
.12	Chem. mechanics
.13	Electrochem.
.14	Photochem.
.15	Radiation chem.
.17	Topochem
.18	Colloid chem.
.2	Atomic theory
.5	Valency, affinity, bonds
.6	Structure in relation to properties
.7	Allotropy
.8	Solutions

Bliss (continued)

CD	Chemical dynamics
C	Statics
D	Equilibria
I	Catalysis
L	Piezochem
M	Valency
N	Thermodynamics
P	Thermochem
T	Colloids
U	Surface chem
V	Solutions
CE	Electrochem
CF	Radio-,photo-chem

Colon

E:2	Physical chem.
21	Chem.combination (incl:Molec.structure)
22	Solution
23	Mixture (incl. Surface, colloid)
24	Thermodynamics
25	Photochem
26	Electrochem
27	Magnetochem
28	Stereochem
296	Radiochem.

Sample comparison with TEST Table 14

	Dewey	UDC	Bliss	Colon
Thermodynamic properties	<536.7	<536.7	<BHB	<C4:7
Dissociation energy		-		
Enthalpy		-		
Entropy	536.73	536.75	BHE	
Free energy		536.77		
Gibbs free energy		<536.775		
Helmholtz free energy		<536.775		
Solidification points	<536.42	536.421.4	<BGV	
Thermal expansion	<536.41	536.41	<BHQ	
Thermochemical	<541.362		CDP	
Heat of ablation		-		
absorption		-		
activation		-		
adsorption		536.658		
crystallization		-		
mixing		-		
Heat of reaction	<541.362	536.66		
Calorific value		-		
Combustion	<541.362	536.662		
Dissociation		536.657		
Formation	<541.362	-		
Hydration		536.664		
Heat of solution	<541.362	536.653		
transformation		536.656		
Latent heat		536.65		
of fusion	<536.42	536.652		C4:514
of sublimation	536.445	536.654		
of vaporisation	<536.443	536.655		C4:554
Thermophysical				
Boiling point	<536.443	536.423.1	<BGV	C4:552
Critical point	<536.443	536.44	<BGV	C4:582
pressure		-	<BGJ	
temperature		-	<BGV	
volume		-		
Emissivity			<BHW	
Melting point	<536.42	536.421.1	<BGV	C4:512
Peltier effect		537.322		
Pyroelectricity	537.65	537.227	BKW	
Seebeck effect		-		
Sensible heat		-		
Softening points		536.421.2		
Specific heat	536.63	536.63	BHJ	C4283
Sublimation pressure		536.422.15		
Surface energy		-		
Thermal conductivity	536.2012	536.2.022	BHU	<C424
Thermal diffusivity	536.2014	-		
Thermal stability		-		
Vapour pressure		536.423.15		
Volatility		536.423.16		

Table 15

Summary of comparisons with TEST

Hierarchy	Terms	Dewey	Bliss	Colon	UDC	Comments
Acid halides	6	1	1	1	6	B and C not specific
Acyclic alcohols	9	1	6	6	9	B not specific
Aerodynamic characteristics	14	10	1	0	11	B not specific
Aldehydes	10	5	1	6	10	B and D not specific, D scattered
Algebra	54	15	19	18	23	B,D,C not specific & scattered, U scattered
Alkaloids	26	1	1	1	24	
Alkene compounds	32	2	3	9	32	B not specific; C scattered
Aluminum alloys	16	1	1	1	16	
Aluminum inorganic compounds	13	3	1	13	13	Some B not specific C scattered
Amides	43	6	1	4	35	B,D,C not specific, D scattered
Analysis (maths)	90	19*	42	40	42	B often not specific; B,C,D scattered
Aquatic animals	49	45	45	7*	16	D and U often not specific, B sometimes; B,C,D,U scattered; U has few vernacular names in schedule.
Bacteria	180	24	38	1	48	D often not specific. B scattered
Beams(radiation)	12	2*	1*	1*	6	D and B not specific, U scattered
Body fluids	13	8*	10*	4*	8*	B,C,U scattered, B and D not specific
Bosons	9	4*	2*	1*	3*	B not specific, U scattered
Capacitors	12	1	1	0*	11	B not specific
Carbides	18	18	0*	18	18	B scattered
Carbohydrates	33	6	20	13	30	
Cardiovascular system	13	10	8*	8	12	B and D not specific
Celestial bodies	32	25	25	20	24	B and D scattered
Cements	26	3*	2	1	7	
Chemical properties	27	9*	3*	2*	12*	D not specific and scattered, U scattered
Chemical reactions	92	27*	4*	4*	32	B,C,D scattered and not specific
Chemical tests	30	21*	14*	11*	25	B and D not specific, B,C,D,U scattered
Circuits	48	2	1	0*	8	B not specific, U scattered
Computer systems hardware	37	2	0*	1	13	C not specific
Congenital abnormalities	37	1	10	0*	30*	D not specific, B U scattered
Crystal defects	10	0*	0*	0*	1	
Crystals	13	1	2	1	6	
Diodes	12	2	0*	0*	6	

Continued overleaf

Table 15 (continued)

Hierarchy	Terms	Dewey	Bliss	Colon	UDC	Comments
Dispersions	16	7*	3*	3*	6	B scattered, D not specific
Drugs	89	22*	20*	1	54	Band D not specific
Earth atmosphere	36	12	6	1	5	D scattered, B not specific
Electrical properties	32	10*	11*	1*	15*	B and D scattered and not specific, U scattered
Electric current	18	4*	4	3	12	B,U scattered
Electromagnetic interference	23	0*	1	0*	17	B not specific
Electromagnetic properties	23	15*	11	11*	14	B,C,D scattered, some not specific, U scattered
Electromagnetic radiation	63	12*	12	14	26	B,C,D,U scattered
Electron tubes	46	14*	5	0*	27	B and D not specific; D scattered
Enzymes	76	12	5	3	27	D scattered
Magnetic properties	22	12	7*	5	12	
Mechanical properties	118	20*	6*	0*	53	B and D scattered and not specific
Mechanical tests	37	12	0*	0*	19	D not specific
Mechanical waves	22	6*	4*	2*	11	B,D,U scattered
Number theory	23	8*	9	4	14	B and D not specific, B,C and D scattered
Numerical analysis	25	4	7	4*	8	B and D not specific; B,C, D,U scattered
Operations research	22	2	0*	0*	1	
Particle accelerators	17	8	3	0*	12	B and D not specific
Spectra	29	8	8	4	23	B and D not specific, B scattered
Statistical analysis	38	1	1	0*	6	
Stochastic processes	5	0*	0*	0*	0*	
Thermodynamic properties	49	19	11	8	29	B and D not specific; B,C, D scattered
Welding	48	10	5	0*	33	D not specific
Totals	1893	493	402	256	961	
Asterisks	-	21	20	26	6	
Not specific	-	24	30	6	1	
Scattered	-	20	20	13	17	
Hierarchies	54	-	-	-	-	

* Highest term not in schedules

Sample comparisons with MESH

Table 16

	Dewey	UDC	Bliss	Colon
1) Parts of body	611	611.9	<HD	-
Head	611.91	-	<HDO	L18
Face	611.92	611.92	-	L181
Mouth	611.31	611.31	<HFC	L21
Tongue	611.313	611.313	<HFC	L213
Taste buds	<611.313	611.87	<HGW	-
2) Nervous system	611.8	611.8	HG	L7
Peripheral nerves	<611.83	611.83	HGI	L75
Cranial nerves	"	611.831	HGGW	L7518
Acoustic nerves	<612.858	611.831.8	HXG	L76183
Cochlear nerve	-	611.831.81	-	-
3) Cells	574.87	576.3	EC	G11
Cytoplasm	574.8734	576.311	ECH	G112
Organoids	-	-	-	-
Endoplasmic reticulum	-	-	-	-
Ribosomes	-	-	-	-
4) Animals	592/599	592/599	GK	K
Invertebrates	592	592	GL	K1
Arthropods	595.2	595.2	GP	K8
Insects	595.7	595.7	GQ	K86
Diptera	595.77	595.77	GQV	K871
Mosquitoes	<595.771	-	<GQVC	-
Anopheles	-	-	"	-
5) Bacteria	589.9	576.85	FLD	<I21
Actinomycetales	589.92	576.852	FLDN	-
Mycobacterium	<589.92	576.852.21	HQJ	-
M.tuberculosis	-	576.852.211	HQK	-
6) Infectious diseases	616.91/.96	616.9	HQ	-
Virus diseases	<616.92	616.988	HQQ	L:423
Myxovirus	-	-	-	
Influenza	616.203	616.921.5	HQTB	L4:4241
Asian	<616.203	-	-	-
7) Hypersensitivity	-	616.056.3	<HQAP	-
H, immediate	-	-	"	-
Anaphylaxis	616.97	612.017.3	"	-
Drug h.	<616.975	-	-	-
Dermatitis medicamentosa	-	616.5.056.3	-	-
Epidermal necrolysis	-	-	-	-

Summary of comparisons with MESH

Table 17

Hierarchy	Length	Dewey	Bliss	Colon	UDC	Comments
Taste buds	6	6	5	4*	5	B,C,D,U scattered
Elbow joint	6	6	5	3*	5	B,C scattered
Anus	6	5	6	5	5	U scattered
Cochlear vein	5	4*	4*	4*	5	B,C,D scattered
Ribosomes	5	2*	2*	2*	2*	
Anopheles	7	6*	7	5*	5*	
Mycobacterium tuberculosis	4	3*	4	1*	4	B scattered
Asian influenza	5	4	3*	2*	3*	C,D,U scattered
Melorheostosis	4	2*	2*	1*	3*	
Ochronosis	5	1*	1*	1*	3	U scattered
Epidermal necrolysis	6	2*	3*	0*	3*	U scattered
Calcium phosphates	5	4*	2*	5	5	C scattered
Uropepsin	6	2*	2*	2*	4*	
Glucosamine	4	1*	1*	1*	4	
Splenoportography	5	2*	2*	2*	3*	
Totals	79	50	49	38	59	
Asterisks	-	11	10	13	7	

* lowest term not found in classification

Summary of comparisons with Euratom

Table 18

Chart.		Keywords		Non-keywords		UDC core	Keywords + terms
No.	Name	Eur.	UDC.	Eur.	UDC.		Class distribution
44	Energy & matter	24	9	152	8	13	539.1 541.5
45	Nuclear reactions	23	16	134	9	12	539.17 539.16 539.12 539.18 539.19 623.45 535.34
46	Radiations	26	21	80	7	8	539.12 539.17 537.5 538.56 535 621.3 616
47	Particles	20	13	101	4	9	539.12 539.18 539.19 537.5
48	Protons **and** neutrons	21	15	51	1	13	539.125 539.17 621.039
49	Leptons and hyperons	19	12	75	15	8	539.126 539.124 539.123 539.18 539.16 537.5 621.384
50	Reactor types	5	4	13	8	7	621.039.52 621.039.57 621.039.51
51	Reactor materials	23	22	8	3	23	621.039.53 621.039.54 621.039.52 621.039.51 546,212
52	Reactor parts	13	10	14	4	10	621.039.53 621.039.54 621.039.55 621.039.56 621.039.51
53	Reactor operation	26	22	41	10	8	621.039.56 621.039.55 621.039.54 621.039.58 621.03951 621.398 62-519 614.8 697.9 542.1 004
54	Radiation detectors	23	18	26	2	12	539.1.074 539.1.073 539.12 539.073
55	Plasma physics	14	10	66	8	4	533.9 537.5 538.4 621.039.6
56	Accelerators	10	9	23	5	12	621.384.6 539.1
	Totals	247	181	784	84	139	

Table 19

Biochemistry in MESH and TEST

MESH

- Biochemistry
  - Blood coagulation
    - B.c. factors
      - Calcium
      - Fibrin
      - Fibrinogen
      - Prothrombin
      - Thrombin
      - Thromboplastin
    - B.c. Tests
      - Thromboelastography
    - Fibrinolysis
    - Prothrombin time
  - Metabolism
    - Basal m.
    - Body temperature
      - B.t. regulation
        - Sweating
      - Hypothermia
    - Calcification
      - Dentition
      - Ossification
    - Carbohydrate m.
      - Krebs cycle
    - Energy m.
    - Hematopoiesis
      - Erythropoesis
    - Lipid m.
    - Mineral m.
      - Iron m.
    - Photosynthesis
    - Pigmentation
    - Protein m.
    - Tissue m.
    - Water-electrolyte balance
  - Nitrogen fixation
  - Nutrition
    - Digestion
      - Defecation
      - Deglutition
      - Eructation
      - Mastication
      - Salivation
      - Urination
        - Diuresis
        - Natruresis
    - Infant n.
      - Breast feeding
      - Lactation
    - N.surveys
  - Respiration
    - Pulmonary circulation

TEST

- Biochemistry
  - Cytochemistry
    - RT Cytology
  - RT Bacteriology
    - Metabolism
      - Carbohydrate m.
      - Lipid m.
      - Mineral m.
      - Nitrogen m.
      - Oxygen consumption
      - Protein m.
    - Nutrition
      - Animal n.
      - Human n.
        - Infant n.
      - Plant n.
    - Pharmacology
      - Psychoneuropharmacology
    - Physiology
      - Animal p.
      - Comparative p.
      - Electro p.
      - Patho p.
      - Physiological psychology
      - Plant metabolism
      - Plant
      - Plant reproduction
  - Biochemical cycles
    - Carbon dioxide c.
    - Iodine c.
    - Nitrogen c.
    - Phosphorus c.
    - Silicon c.
  - Biochemical oxygen demand

Table 20

Physiology in TEST and MESH

TEST

- Physiology
  - Animal
  - Comparative p.
  - Electro p.
  - Patho p.
  - Physiological psychology
  - Plant metabolism
  - Plant p.
    - Plant reproduction
  - RT Biochemistry (q.v.)
    - Endocrinology
    - Homeostatis
    - Hormones
      - Adrenal cortex h.
        - Aldosterone
        - Corticosterone
        - Cortisone
        - etc
      - Androgens
        - Androsterone
        - Testosterone
      - Corpus luteum h.
        - Progesterone
        - Relaxin
      - Estrogens
        - Estradiol
        - Estriol
        - Estrone
      - Gastrointestinal h.
        - Gastrin
        - Secretin
      - Gonadotropins
        - Prolactin
      - Pituitary h.
        - Corticotropin
        - Intermedin
        - Oxytocin
        - etc
      - Plant h.
        - Gibberellins
      - Progestational h.
        - Pregnanediol
        - etc
      - Thyroid h.
        - Thyroxine
        - etc.
    - Metabolism (see Biochemistry)
    - Neurology
    - Nutrition (see Biochemistry)
    - Pathology
      - Plant p.
    - Peristalsis
    - Physical anthropology
    - Psychology

Continued overleaf

  - Abnormal psychology
  - Clinical p.
  - Criminal p.
  - etc.
- Regeneration
- Responses
  - Avoidance r.
  - Conditioned r.
  - Dynamic r.
  - etc.
- Stress
  - Heat stress

MESH

- Physiology
  - Adaptation
    - Acclimatisation
    - Accommodation, ocular
    - Hibernation
    - Weightlessness
  - Aging
    - Adolescence
      - Puberty
    - Geriatrics
    - Growth
      - Body constitution
        - Body height
        - Body weight
    - Longevity
      - Life expectancy
    - Middle age
      - Climacteric
      - Menopause
    - Pediatrics
      - Child
      - Infant
        - Newborn
        - Premature
    - Rejuvenation
  - Blood circulation
    - B. pressure
    - B. viscosity
    - B. volume
    - Capillary permeability
    - Capillary resistance
    - Maternal-foetal interchange
    - Pulmonary
    - Pulse
      - Plethysmography
  - Blood coagulation (see Biochemistry)
  - Death
    - Cadaver
    - Sudden d.
    - Drowning
    - Fetal d.

Continued overleaf

Table 20 (continued)

- Digestion (see Biochemistry)
- Electrophysiology
- Endocrinology
- Metabolism (see Biochemistry)
- Movement
  - Exertion
    - Sweating
  - Gait
  - Kinesthesis
  - Locomotion
- Nutrition (see Biochemistry)
- Comparative physiology
- Psychophysiology
  - Adaptation
    - Homeostasis
    - Orientation
  - Laterality
  - Mental processes
    - Cognition
      - Learning
        - (subdivisions)
      - Perception
        - Body image
        - Equilibrium
        - Hearing
        - Illusions
        - Sensations
          - (subdivisions)
        - Smell
        - Taste
        - Touch
        - Visual
          - (subdivisions)
      - Thinking
        - (subdivisions)
    - Emotions
      - (subdivisions)
    - Volition
  - Reflex
    - (subdivisions)
  - Stress
- Regeneration
  - Convalescence
  - Wound healing
- Reproduction
  - Biogenesis
  - Breeding
    - Fertilization
    - Insemination
      - Artificial
  - Cell division
  - Coitus
  - Ejaculation
  - Embryology
    - Metamorphosis

Continued overleaf

Table 20 (continued)

- Estrus
- Fertility
- Labor
  - Delivery
- Menstruation
- Ovulation
- Parthenogenesis
- Pregnancy
  - (subdivisions)
- Puerperium
  - Lactation
- Sterility

Respiration

Sneezing

Vision

- Visual fields
  - Perimetry

Viruses in MESH and TEST

Table 21

MESH

- Viruses
  - Animal v.
    - Adeno v.
    - Arbor v.
      - Encephalitic v.
      - Yellow fever v.
    - Entero v.
      - Coxsackie v.
      - Echo v.
      - Polio v.
    - Herpes v.
      - H.hominis v.
      - Varicella v.
    - Myxo v.
      - Fowl plague v.
      - Influenza v.
      - Mumps v.
      - Newcastle v.
      - Para-influenza v.
    - Pox v.
      - Ectromelia v.

      - Smallpox v.
      - Vaccina v.
    - Tumor v.
      - Avian leukosis v.
      - Myxoma v.
      - Papilloma v.
      - Polyoma v.
      - Rous sarcoma v.

- Bacteriophage
  - Coli p.
  - Mycobacterio p.
  - Salmonella p.
  - Staphylococcal p.
- Insect v.
- Plant v.
  - Tobacco mosaic v.
- Common cold v.
- Distemper v.
- Equine v.
- Foot-and-mouth v.
- Hepatitis v.
- Measles v.
- Rabies v.
- Vesicular stomatitis v.

TEST

- Viruses

  - Adeno v.
    - Oncogenic v.
    - Polyoma v.
    - Acute respiratory disease v.

  - Arbo v.
    - Apen v.
    - Chikungunya V.
    - Colorado tick fever v.
    - Dengue v.
    - Equene encephalo v.
    - Japanese encephalitis v.
    - Kyasanur forest v.
    - Louping ill v.
    - Marituba v.
    - Mayaro v.
    - Omsk v.
    - Oriboca v.
    - Rift Valley v.
    - Semliki forest v.
    - West Nile v.
    - Yellow fever v.
  - Bacteriophages
    - Coli p.

  - Measles v.
    - Rubella v.
  - Myxo v.
    - Influenza v.
    - Mumps v.
    - Newcastle v.
    - Para-influenza v.
    - Sendai v.
    - Swine influenza v.
  - Popova v.
    - Papilloma v.
  - Picorna v.
    - Entero v.
      - Coxsackie v.
      - Echo v.
      - Polio v.
    - Foot-and-mouth v.
    - Rhino v.
    - Pox v.
      - Vaccina v.
      - variola v.
    - Colorado tick fever v.

Continued overleaf

Table 21 (contind)

TEST

Hepatitis v.
Herpetic v.
Hog cholera v.
Miyagawanella v.
Monkey B v.
Plant v.
Rabies v.
Reo v.
Rividerpest v.
Vesicular v.

Table 22

Outline of Farradane's facets

- Entities
  - Physical
    - Elementary particles
    - Atomic
    - Molecular
    - Molecular assemblage (e.g. liquid)
    - Ordered assembly (e.g.Mineral)
    - Complex aggregate (e.g. Rock)
  - Chemical
    - Elements
    - Radicals, ions
    - Compounds
    - Complexes (e.g. Resin)
    - Aggregates (e.g. Milk)
  - Living
    - Self-reproducing compounds or complexes (e.g.Virus)
    - Cell components (e.g. Chromosome)
    - Cells (e.g. Cell, Amoeba)
    - Tissues (e.g. Blood)
    - Organs (e.g. Lung)
    - Organ system (e.g. Digestive)
    - Living entity (e.g.Cat)
    - Living group (e.g. Lichen)
  - Artefacts
    - Separated natural materials (e.g. Cane juice)
    - Derived single products (e.g. Screw, Sugar)
    - Assemblies (e.g. Machine)
    - Complex assemblies (e.g. Factory)

- Activities
  - Physical
    - Simple (e.g. Vibrating)
    - Complex (e.g. Grinding)
    - Complex series (e.g. Manufacturing)
  - Living
    - Simple physiological (e.g. Breathing)
    - Complex physiological (e.g. Digesting)
    - Combined complex (e.g. Reproducing)
    - Physiological with mental (e.g. Remembering)

  - Physical abstract
    - Simple (e.g. Increasing)
    - Complex (e.g. Deteriorating)
    - Combined complex
  - Mental abstract
    - Simple (e.g. Counting)
    - Combined (e.g. Calculating)
    - Complex (e.g. Planning)

- Abstracts
  - Physical (e.g. Light)
  - Symbolic
    - Unit level (e.g. Number)
    - Combination (e.g. Formula)
    - Complex (e.g. Circle)
    - Higher level (e.g. Mechanism)

Continued overleaf

Table 22 (continued)

  - Behavioural
  - Space
  - Time
- Properties
  - Pre-concept
    - Physical
      - Simple (e.g. Viscous)
      - Comparative (e.g. Hot)
      - Interactive (e.g. Acid)
      - Interactive with change (e.g. Soluble)

    - Behavioural and physiological
    - Abstract
  - Measurable
    - Physical
      - Simple (e.g. Viscosity)
      - Comparative (e.g.Temperature)
      - Interactive (e.g.Acidity)
      - Interactive with change (e.g.Solubility)
    - Behavioural and physiological
    - Abstract

Objects and phenomena in Physics (A.I.P.) Table 23

Objects

1	Mathematical entities
11	Numerical computational and conceptual aid
12	Geometrical entities
13	Algebraic entities
14	State functions and equations
15	Transition matrices and equations
2	Particles, fields, nuclei, atoms and molecules
21	Particles and fields in general
22	Gravitational fields
23	Electromagnetic fields
24	Leptons
25	Hadrons
26	Cosmic rays and fields
27	Complex nuclei
28	Atoms and molecules
3	Chemical elements and their compounds
4	Ensembles and aggregate matter (see Table 25)
5	Astrophysical and geophysical objects
51	Solar system
52	Stars, clusters
53	Interstellar medium
54	Milky Way
55	Galaxies
56	Quasars, pulsars
57	Universe
59	Other extraterrestrial objects
6	Organisms, biological systems, organs
7	Artifacts, devices, instruments, systems
71	Sources
72	Transmission-handling
73	Detection
74	Containment and control
75	Measuring
76	Computing
77	Energy conversion
78	Environmental probes
79	Architectural
8	Conditions of object e.g. Low temperature

Phenomena and associated properties

1	Mathematical e.g. Solution of equations
2	Particle, field, etc
21	Mass, energy, frequency, wavelength
22	Velocity, momentum
23	Polarisation
24	Quantum numbers
25	Functions
26	Chemical bond type
27	Geometrical structure
28	Level structure, spectra
29	Interactions

Continued overleaf

Table 23 (continued)

3	Chemical
4	Ensemble (see Table 25)
5	Astrophysical and geophysical
6	Psychological and physiological
7	Artifacts
71	Precision, resolution, noise level, signal/noise ratio
72	Sensitivity, dynamic range
73	Output level, intensity, power, gain
74	Accuracy, stability, etc.
75	Feasibility, efficiency, cost
76	Safety,
77	Design, fabrication
78	Testing
79	Operating instructions and parameters

Table 24

Ensembles and associated phenomena in Physics (A.I.P.)

Ensembles and aggregate matter

41	Ensembles of particles, molecules, etc
411	Obeying non-quantum statistics
412	Obeying quantum statistics
42	Excitations in aggregate matter
421	Heat
422	Mechanical, elastic and acoustic waves and oscillations
423	Spin waves
424	Quasiparticles
425	Carriers
43	Imperfections
432	Impurities
433	Point defects
434	Dislocations
435	Stacking faults
436	Associated defects
437	Color centers
44	Fluids
441	Plasmas
442	Gases
443	Liquids
446	Quantum fluids
447	Disperse systems
448	Fluid surfaces and interfaces
45	Fluid/solid systems
451	Condensed phases in general
452	Solid/gas
453	Solid/liquid
46	Solids
461	Crystals
462	Films, membranes
463	Amorphous, vitreous, fibrous
464	Solid/solid
47	Phenomenological descriptions of materials
471	Elastic
472	Plastic
473	Viscous
474	Optical e.g. Luminiscent, photoconductive, laser
475	Electric and magnetic e.g. Semiconductors, ferromagnetic
476	Alloys
477	Solutions
478	Technological (e.g. refractory)

Phenomena associated with ensembles

41	Structure-related
411	Size, shape, etc
412	Crystal structure
413	Electronic structure
414	Potential barriers, work functions
42	Thermal, thermodynamic and statistical
421	Thermodynamic (e.g. temperature, entropy)
422	Specific heats, heat capacities

Continued overleaf

Table 24 (continued)

423	Correlation and collective phenomena
4231	Order parameters, coherence lengths
4232	Stability, instability
424	Heat flow, conduction
425	Diffusion
426	Phase and state
4261	Solubility, miscibility
4262	Phase transitions
4263	Thermal expansion
4264	Equation of state parameters
43	Mechanical and rheological
431	Density
432	Elasticity, compression, expansion
433	Hardness, fracture
434	Strength, fatigue, aging
435	Friction, abrasion, wear
436	Flow, creep, viscosity
437	Plasticity, deformation
438	Technological (e.g. ductility)
44	Electrical and magnetic
441	Charge density, etc
442	Electrical polarization, dielectric constant
443	Magnetization, etc
444	Electromagnetic transport
450	Interaction of particles and waves
451	Wave propagation e.g. Refraction, dispersion, diffraction
452	Resonances and relaxation
453	Fluorescence, etc.
455	Transmission, absorption, etc
46	Emission
461	Spontaneous
462	Stimulated or induced

Table 25

Properties, processes and phenomena in chemical physics (A.I.P.)

Acoustic and ultrasonic
Bond Structure
Charge distribution
Chemical
Collision processes and scattering
Scattering
Colloidal
Detonation and shock wave
Electric and dielectric
Electron
Electronic states
Energy transfer
Energy and potentials
Fluid
Ionic
Isotope effects
Laser and maser
Liquid crystal
Luminescence
Macromolecular
Magnetic
Mass spectra
Mossbauer spectra
Molecular structure
Nuclear
Nuclide
Optical
Quantum mechanical
Radiation effects
Radiochemical
Relaxation
Rotational
Solid state
Solutions
Spin
Surface and film
Thermodynamic and thermal
Vibrational
XRay

Table 26

- Thermodynamic and thermal properties (A.I.P.)
    - Accomodation Coefficients
    - Activity
    - Compressibility
    - Critical Properties
        - Critical Point
    - Density
    - Energy
        - Configurational Energy
        - Energy of Activation
        - Energy of Formation and Dissociation
        - Energy of Fusion
        - Energy of Hydration
        - Energy of Mixing
            - Energy of Solution
        - Energy of Transition
        - Energy of Vaporisation
            - Energy of Evaporation
            - Energy of Sublimation
        - Zero-point Energy
    - Enthalpy
        - Enthalpy of Activation
        - Enthalpy of Formation and Dissociation
        - Enthalpy of Fusion
        - Enthalpy of Hydration
        - Enthalpy of Mixing
            - Enthalpy of solution
        - Enthalpy of Transition
        - Enthalpy of Vaporisation
            - Enthalpy of Evaporation
            - Enthalpy of Sublimation
    - Enthropy
        - Entropy of Activation
        - Entropy of Formation and Dissociation
        - Entropy of Fusion
        - Entropy of Hydration
        - Entropy of Mixing
            - Entropy of Solution
        - Entropy of Transition
        - Entropy of Vaporisation
            - Entropy of Evaporation
            - Entropy of Sublimation
    - Equation of State
        - Virial Coefficients
    - Formation Constant; Association Constant
    - Free Energy
        - Free Energy of Activation
        - Free Energy of Formation and Dissociation
        - Free Energy of Fusion
        - Free Energy of Hydration
        - Free Energy of Mixing
            - Free Energy of Solution
        - Free Energy of Transition
        - Free Energy of Vaporization
            - Free Energy of Evaporation
            - Free Energy of Sublimation

Continued overleaf

- Heat Capacity
- Partition Functions
- Phase Transition
- Phase Diagram
- Pressure
  - Partial Pressure
  - Vapor Pressure
- Temperature
- Thermal conductivity
- Thermal Diffusion
- Thermal Expansion Coefficient
- Volume
  - Free Volume
  - Partial Molar Volume
- Work Function

Table 27

Classification of fundamental sciences (Auger)	Dewey
Mathematics: Pure and applied	510
Mathematics	510
Algebra	512
Topology	513.83
Differential geometry	516.7
Theory of functions and functional analysis	517.5
Probability and statistics	519
Automatics	510.78
Analogue computers	510.782
Digital computing	510.783
The physical sciences	530
Theoretical physics	530.1
Asymptotic behaviour as starting point of the theory	-
The non-linear spinor theory	-
Mathematical methods and quantum field theory	530.143
Possibilities of a geometric theory of pure field	530.14
Recent Research on the gravitational field	521.12
Atomic physics	539.1
Quantum mechanics of the atom	530.123
Atomic and physical constants	539.14
Elementary atomic particles	539.721
Simple atomic systems	<539.14
Complex composite atomic systems	<539.14
Externally perturbed atoms	<539.14
Internally perturbed complex atomic systems	<539.14
Collisions of atomic particles	-
Plasma	537.16
Radiation and its interaction with matter	<535/537
Nuclear physics and high energy particle physics	539.7
High energy particle physics	<539.7
Medium and low energy nuclear physics	-
Experimental technique	539.73+.77
Radiant energy	535/537
Optics	535
Image formation	-
Optical materials	<535.33
Optical receptors	-
Electronics	537.5
Vacuum tubes	<537.53*
Gas discharge tubes	<537.53
Electron microscopy	<537.56
Solid state devices	621.38152
Masers	<537.5344
Parametric amplifiers	<621.381535
Principles of circuity	537.5353
Electronic instruments	621.38133
Computers	621.38195
Telecommunications	<621.38
Radar	621.3848
Heat transfer and low temperatures	<536

---

* or 621.381512

Table 27 (continued)

	Dewey
Heat transfer and insulators	536.2
Very low temperature physics	536.56
Magnetism and electricity	537/538
Electrostatics	537.2
Magnetism	538
Electrodynamics	537.64
The states of matter	530.4
Fluid mechanics	532
Mechanics of conventional fluids	<532
Mechanics of non-conventional fluids	-
High pressures	-
Thermodynamic properties - The molecular theory of dense fluids	<536.71
The physics of solids at high pressures	-
Dynamics of crystal lattices	-
The physics of solids at very high pressures- Allotropic transformations	<541.7
Electronic transformations and ionization by compression at extremely high pressures	-
Very high dynamic pressures in shock waves	-
Chemical reactions at high pressures	-
Low pressures	533.5
Production of the vacuum	533.54
Measurement of low pressures	-
Composition of gases. Leaks	544.4
Solid state physics	530.41
Experimental methods	-
Structure analysis	548.8
Mechanical properties	548.84
Optical properties	548.9
Semiconductors	537.622
Work on germanium and silicon	<546.68
Fundamental devices	621.381.52
Alloys	546.37
Superconductors	537.623
Superconductivity	<537.623
Quantum theory of the conductivity of crystals	<548.85
The chemical sciences	540
General chemistry	541
Thermochemistry and chemical thermodynamics	541.36
Electrochemistry	<541.37
Chemical kinetics and combustion	541.39
Catalysis and catalysts	541.395
Analytical chemistry	543/545
Nuclear chemistry	541.38
Chemical effects of radiation	ditto
Radiochemistry	ditto
Inorganic chemistry	546
Inorganic macromolecules	<541.2254
Compounds of the transition metals	546.62/64
Fluorine derivatives	546.731
Compounds for the electronics industry	-
Non-metallic materials for astronautical purposes	-

Continued overleaf

Table 27 (continued)

	Dewey
Metallurgical chemistry	669.92
The vitreous state	-
Organic chemistry	547
Organo-metallic chemistry	547.05
Silicon compounds	547.08
Organic fluorine compounds	<547.02
The biological sciences	570/590
Biochemistry and biophysics	574.19
Intermediary metabolism	-
Photosynthesis	581.13342
Enzyme biocatalysis (enzymology)	574.1925
Chromosome biochemistry	<574.8732
Cell biology	574.87
Ultra-microscopic structure	-
Transport through membranes	<574.875
Excitability and contractility	-
Differentiation and ageing	574.8765
General physiology	574.1 or 612
Microphysiology	574.876
Renal physiology	612.463
Synthetic physiology	-
Neurophysiology	612.8
Plant biology	580
The organization of the plant cell	581.872
Growth and development	581.3
Genetics and taxonomy	581.15
Animal biology	590
Invertebrates	592/595
Vertebrates	596/599
Radiobiology	574.1915
The cytobiology of radiation	-
Somatic effects of whole-body irradiation on multicellular organisms	612.01448
Genetic effects of radiation	575.131
The earth and space sciences	52+55
The land mass	551.1/.2
The earth crust	551.13/.14
The internal structures	551.11/.12
The hydrosphere	<551.4
The oceans	551.46/.47
Hydrology	551.48/.49
The atmosphere. Meteorology	551.5/.6
The very high atmosphere and outer space	
Aeronomics	-
Space	523.111
Astronomy - Astrophysics	520
Stars	523.8
Galaxies	523.112

Appendix 4

Survey of UDC Editions*

authorized by the Fédération Internationale de Documentation [FID]

FULL EDITIONS

English

Universal Decimal Classification (Fourth International Edition) (FID No. 179). London, British Standards Institution.

Each part contains an alphabetical subject index unless otherwise stated.

BS 1000: Vol. 1, Part 1: 1943	General introduction. Auxiliary tables. UDC 0 Generalities. 60 pp. 4to. 15/–. Without alphabetical subject index.
BS 1000: Vol. 2, Part 1: 1943	UDC 50 General works on pure science. UDC 51 Mathematics. UDC 52 Astronomy, geodesy. UDC 53 Physics 104 pp. 4to. 15/–.
BS 1000: Vol. 2, Part 2: 1943	UDC 54 Chemistry [crystallography, mineralogy].
BS 1000: Vol. 2, Part 3: 1943	UDC 55 Geology, geophysics. UDC 56 Palaeontology. UDC 57 Biology. UDC 58 Botany. UDC 59 Zoology. 124 pp. 4to. 15/–. Alphabetical subject index also available separately if required, 3/6.

Since sections of BS 1000 are not issued in consecutive UDC order, the use of volume and part numbers was abandoned after 1943 and replaced by the UDC number itself in brackets after the designation BS 1000.

BS 1000 [611]: 1968	UDC 611 Anatomy. 26 pp. A4. 20/–.
BS 1000 [612]: 1968	UDC 612 Physiology. 40 pp. A4. 25/–.
BS 1000 [613]: 1968	UDC 613 Hygiene. 16 pp. A4. 15/–.
BS 1000 [615]: 1968	UDC 615 Pharmaceutics. Therapeutics. Toxicology. 20 pp. 4to. 15/–.
BS 1000 [617]: 1968	UDC 617 Orthopaedics. Surgery. Ophthalmology. 20 pp. A4. 15/–.
BS 1000 [621.3]: 1964	UDC 621.3 Electrical engineering. 68 pp. A4. 40/–.
BS 1000 [622/623]: 1955	UDC 622 Mining and mineral dressing. UDC 623 Military and naval engineering, ordnance, arms production. 52 pp. 4to. 15/–.
BS 1000 [624]: 1968	UDC 624 Civil and structural engineering in general. 24 pp. A4. 20/–.
BS 1000 [65/651+657/659]: 1968	UDC 65/651 Business and industrial organization and management. Communication. 39 pp. A4. *Price to be determined.*
BS 1000 [669]: 1949	UDC 669 Metallurgy. 44 pp. 4to. 15/–.
BS 1000 [678/679]: 1954	UDC 678 Macromolecular materials (rubbers and plastics). UDC 679 Industries based on stone and other processable materials. 36 pp. 4to. 15/–.
BS 1000 [681.3]: 1968	UDC 681.3 Data processing machines, etc. 12 pp. A4. 15/–.
BS 1000 [684]: 1968	UDC 684 Furniture and allied trades. 11 pp. A4. 15/–.
BS 1000 [69]: 1958	UDC 69 Building. Materials, construction, trades. 40 pp. 4to. 15/–. Amendment PD 5996, March 1967.
BS 1000 [73/76]: 1968	UDC 73/76 Fine and applied arts. 16 pp. A4. 15/–.
BS 1000 [77]: 1968	UDC 77 Photography. 33 pp. A4. 20/–.

French (3rd edition)

Classification Décimale Universelle. (5e édition internationale.)
Brussels, Editiones Mundaneum.

UDC 0: 1951 (*out of print*).
UDC 2: 1951 (*out of print*).
UDC 3: 1952 (*out of print*).
UDC 61: 1940 (*out of print*).
UDC 62: 1941 (*out of print*).
UDC 65: 1942 (*out of print*).

German (1st and 2nd editions)

DK Dezimalklassifikation. Deutsche Gesamtausgabe. (Dritte und achte Internationale Ausgabe).
Berlin, Deutscher Normenausschuss.

UDC 0/2: 1934 (repr. 1948).
UDC 3/4: 1935 (repr. 1948) (*out of print*).
UDC 5: 1958 2nd ed., (repr. 1964).
UDC 6/61: 1951 (repr. 1964).
UDC 62: 1964 2nd, loose leaf ed.
UDC 63/65: 1965 2nd, loose leaf ed.
UDC 66: 1965 2nd, loose leaf ed.
UDC 67/9: 1948 (*out of print*).

Supplement sheets incorporating latest extensions are published in 'DK Mitteilungen' (FID No. 304).

Japanese

Kokusai Zyussin Bunruihô (FID No. 253).
Tokyo, Nippon Dokumentêsyon Kyôkai.

UDC 5: 1951.
UDC 6/61: 1955.
UDC 62: 1952.
UDC 63: 1957.
UDC 66: 1952.

Polish

Uniwersalna Klasyfikacja Dziesiętna. Pelne Wydanie Polskie Dziesiąte Wydanie Międzynarodowe (FID No. 327).
Warsaw, Centralny Instytut Informacji Naukowo-technicznej Ekonomicznej.

UDC 0: 1962.
UDC 51: 1965.
UDC 528/529: 1964.
UDC 53: 1959.
UDC 541/547: 1965.
UDC 55: 1966.
UDC 56/57: 1965.
UDC 58: 1966.
UDC 59: 1965.
UDC 620/621: 1966.
UDC 622: 1965.
UDC 623: 1964.
UDC 624/628: 1964.
UDC 669: 1965.
UDC 671/676: 1965.
UDC 677: 1964.
UDC 678/679: 1964.
UDC 681: 1963.
UDC 682/685: 1964.
UDC 686/689: 1963.
UDC 69: 1963.

Portuguese

Classificação Decimal Universal. Edição Desenvolvida em Língua Portuguesa (FID No. 342). Lisbon, Centro de Documentação Científica do Instituto de Alta Cultura (CDC).
and
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentação (IBBD).

UDC 0: 1961.
UDC 1: 1963.
UDC 2: 1963.

Spanish

Clasificación Decimal Universal. Tablas Completas. Edición en español (UNE 50 002) (FID No. 243).
Madrid, Instituto Nacional de Racionalización del Trabajo.

UDC 0: 1955.
UDC 1: 1964.
UDC 2: 1959.
UDC 3: 1959 (*out of print*).
UDC 3: 1963 (*out of print*).
UDC 57/59: 1966.
UDC 61: 1958 (*out of print*).
UDC 62/621.398: 1959. (*out of print*) (*2nd ed. in* preparation).
UDC 621.4/624 972: 1965.
UDC 63: 196[illegible]
UDC 7: 1957. (*out of print*).

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* For residents in the U.K. *only*, obtainable through BSI, 101 Pentonville Road, London, N.1. For residents in other countries, obtainable through FID, 7 Hofweg, The Hague, Netherlands.

A sample hierarchy

Figure 1

D

MACHINES AND SYSTEMS

MECHANICAL AND THERMAL PLANT AND MACHINES (cont'd.)

Dk	Nuclear Reactors* (cont'd.)
Dkb/v	Heterogeneous Reactors (cont'd.)
Dkb/g	Thermal (cont'd.)

By moderator:

Dkc	Graphite
Dkcb	Beryllium
Dkd	Water, light
Dkdb	Boiling water
Dkdd	Pressurised water
Dke	Water, heavy
Dkeb	Boiling water
Dked	Pressurised water
Dkf	Hydrogen, hydrides
Dkg	Organic compounds

By coolant:

m	Gas
n	Air
p	Hydrogen
q	Carbon dioxide
r	Helium
rn	Nitrogen and other gases
s	Water, light
sb	Boiling, steam
sd	Pressurised
t	Water, heavy
tb	Boiling, steam
td	Pressurised
u	Organic
v	Liquid metals
vb	Bismuth
vl	Lithium
vm	Mercury
vp	Potassium
vs	Sodium

Dkcqb	*Advanced gas cooled reactors*
Dkcr	*High temperature reactor*

cont'd. . . .

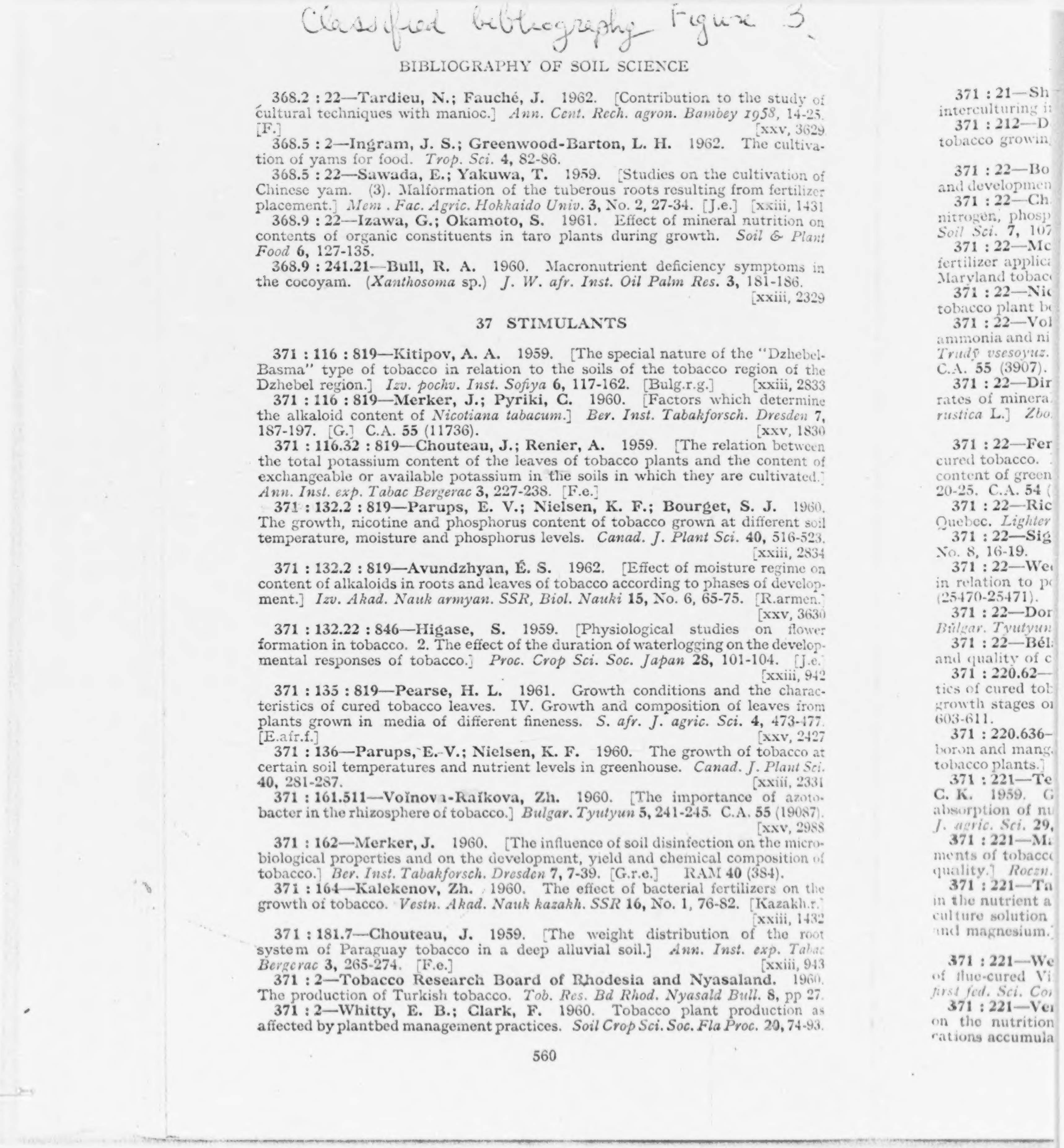
Figure 2

ALPHABETICAL SUBJECT INDEX (cont'd.)

Barium	Nba
Barometers	Zgk
Barometric Partial Systems Guidance: Guided Missiles	Xgcc
Barrel Windings	Htv
Barrelling, Cleaning	Vvc
Barretters	Icc
Bars: Commutators	Hqy
Bars: Flat Springs	Kelb
Bars: Manufactured Form	ait
Bars: Structural Parts	Kwg
Base Cut: Receivers	Ck Flm
Base Rise: Receivers	Ck Flh
Basic Bessemer Steel	Ns.bj
Basic Open Hearth Steel	Ns.bf
Baskets	Kcw
Batteries	Hn
Bauschinger Effect	Pgcb
Beacon System Externally Aided Guidance: Guided Missiles	Xgcd
Beacon Transponders: Radio Navigational Aids	Ccr
Beam Approach: Radio Navigational Aids	Ccf
Beam Plates: Electrodes	Itf
Beam Switches	Hhh
Beam Riding Guidance: Guided Weapons, Spacecraft	Xgci
Beams	Kwb
Beams, Atomic	Szwx
Beams, Molecular	Szyx
Beams, Deflection: Electrodes	Itl
Bearings	Jt
Beat Frequency Oscillators	Gdt
Beats: Sound, Vibrations	Ty
Bechuanaland	681
Bedplates	Kbh
Beforehand	ayb
Beilby Layer: Grain Structure, Microstructure	Odc
Belgian Congo	675
Belgium	493
Bell X 15 Aircraft	Efc
Bellini Toziaerial Antennas	Cm.fw
Bellows	Kybm
Below	ast
Belt Conveyors	Zse
Belt Transmissions	Jpb

Bend Testing	Xtbg
Bending	Ppg
Bending: Mechanical Working	Vhr
Bending Properties	Pbcn
Bending Stress	Ppg
Bends	Kxly
Benson Boilers	Dbzs
Bent	aly
Bent Tube Boilers	Dbzq
Benzene	Mggk
Berkelium	Nbk
Beryllium	Nbe
Beryllium Canned CO_2 Graphite Reactors	Dkcqb
Beryllium Moderated Reactors	Dkcb Dkkcb Dkwrcb
Bessel Function	Ymg
Bessemer Furnaces	Zrj
Bessemer Steel	Ns.bg
Beta Particles	Sbe
Beta Phase: Metals	N.β
Bevel Gauges	Zck
Bevel Gears	Jmf
Bevelled Tooth Shape: Gears	Jmr
Beverages	Lt
Bibliographies	21
Bibliographies of Bibliographies	2
Bicycles	Elv
Bifurcate	anw
Big Ends	Jkcn
Billets	ait
Bills of Exchange	Wehe
Bills of Lading	Wehf
Bills Discounting	Wehh
Biochemical Operations: Chemical Engineering	Uky
Biographies	383
Biological Corrosion	Opv
Biological Shielding: Nuclear Reactors	Dk Fkc
Biology	TA[57]
Biplanes	Ebg 2
Bismuth	Nbi
Bismuth Cooled Reactors	Dkbvb Dkkvb Dklvb
Bituminous Coal	Mmb

Index 6



Classified bibliography Figure 3.

368.2 : 22—Tardieu, N.; Fauché, J. 1962. [Contribution to the study of cultural techniques with manioc.] *Ann. Cent. Rech. agron. Bambey 1958*, 14-25. [F.] [xxv, 3629

368.5 : 2—Ingram, J. S.; Greenwood-Barton, L. H. 1962. The cultivation of yams for food. *Trop. Sci.* **4,** 82-86.

368.5 : 22—Sawada, E.; Yakuwa, T. 1959. [Studies on the cultivation of Chinese yam. (3). Malformation of the tuberous roots resulting from fertilizer placement.] *Mem . Fac. Agric. Hokkaido Univ.* **3,** No. 2, 27-34. [J.e.] [xxiii, 1431

368.9 : 22—Izawa, G.; Okamoto, S. 1961. Effect of mineral nutrition on contents of organic constituents in taro plants during growth. *Soil & Plant Food* **6,** 127-135.

368.9 : 241.21—Bull, R. A. 1960. Macronutrient deficiency symptoms in the cocoyam. (*Xanthosoma* sp.) *J. W. afr. Inst. Oil Palm Res.* **3,** 181-186. [xxiii, 2329

37 STIMULANTS

371 : 116 : 819—Kitipov, A. A. 1959. [The special nature of the "Dzhebel-Basma" type of tobacco in relation to the soils of the tobacco region of the Dzhebel region.] *Izv. pochv. Inst. Sofiya* **6,** 117-162. [Bulg.r.g.] [xxiii, 2833

371 : 116 : 819—Merker, J.; Pyriki, C. 1960. [Factors which determine the alkaloid content of *Nicotiana tabacum.*] *Ber. Inst. Tabakforsch. Dresden* **7,** 187-197. [G.] C.A. **55** (11736). [xxv, 1830

371 : 116.32 : 819—Chouteau, J.; Renier, A. 1959. [The relation between the total potassium content of the leaves of tobacco plants and the content of exchangeable or available potassium in the soils in which they are cultivated.] *Ann. Inst. exp. Tabac Bergerac* **3,** 227-238. [F.e.]

371 : 132.2 : 819—Parups, E. V.; Nielsen, K. F.; Bourget, S. J. 1960. The growth, nicotine and phosphorus content of tobacco grown at different soil temperature, moisture and phosphorus levels. *Canad. J. Plant Sci.* **40,** 516-523. [xxiii, 2834

371 : 132.2 : 819—Avundzhyan, É. S. 1962. [Effect of moisture regime on content of alkaloids in roots and leaves of tobacco according to phases of development.] *Izv. Akad. Nauk armyan. SSR, Biol. Nauki* **15,** No. 6, 65-75. [R.armen.] [xxv, 3630

371 : 132.22 : 846—Higase, S. 1959. [Physiological studies on flower formation in tobacco. 2. The effect of the duration of waterlogging on the developmental responses of tobacco.] *Proc. Crop Sci. Soc. Japan* **28,** 101-104. [J.e.] [xxiii, 942

371 : 135 : 819—Pearse, H. L. 1961. Growth conditions and the characteristics of cured tobacco leaves. IV. Growth and composition of leaves from plants grown in media of different fineness. *S. afr. J. agric. Sci.* **4,** 473-477. [E.afr.f.] [xxv, 2427

371 : 136—Parups, E. V.; Nielsen, K. F. 1960. The growth of tobacco at certain soil temperatures and nutrient levels in greenhouse. *Canad. J. Plant Sci.* **40,** 281-287. [xxiii, 2331

371 : 161.511—Voĭnova-Raĭkova, Zh. 1960. [The importance of azotobacter in the rhizosphere of tobacco.] *Bulgar. Tyutyun* **5,** 241-245. C.A. **55** (19087). [xxv, 2988

371 : 162—Merker, J. 1960. [The influence of soil disinfection on the microbiological properties and on the development, yield and chemical composition of tobacco.] *Ber. Inst. Tabakforsch. Dresden* **7,** 7-39. [G.r.e.] RAM **40** (384).

371 : 164—Kalekenov, Zh. 1960. The effect of bacterial fertilizers on the growth of tobacco. *Vestn. Akad. Nauk kazakh. SSR* **16,** No. 1, 76-82. [Kazakh.r.] [xxiii, 1432

371 : 181.7—Chouteau, J. 1959. [The weight distribution of the root system of Paraguay tobacco in a deep alluvial soil.] *Ann. Inst. exp. Tabac Bergerac* **3,** 265-274. [F.e.] [xxiii, 943

371 : 2—Tobacco Research Board of Rhodesia and Nyasaland. 1960. The production of Turkish tobacco. *Tob. Res. Bd Rhod. Nyasald Bull.* **8,** pp 27.

371 : 2—Whitty, E. B.; Clark, F. 1960. Tobacco plant production as affected by plantbed management practices. *Soil Crop Sci. Soc. Fla Proc.* **20,** 74-93.

371 : 21—Sh
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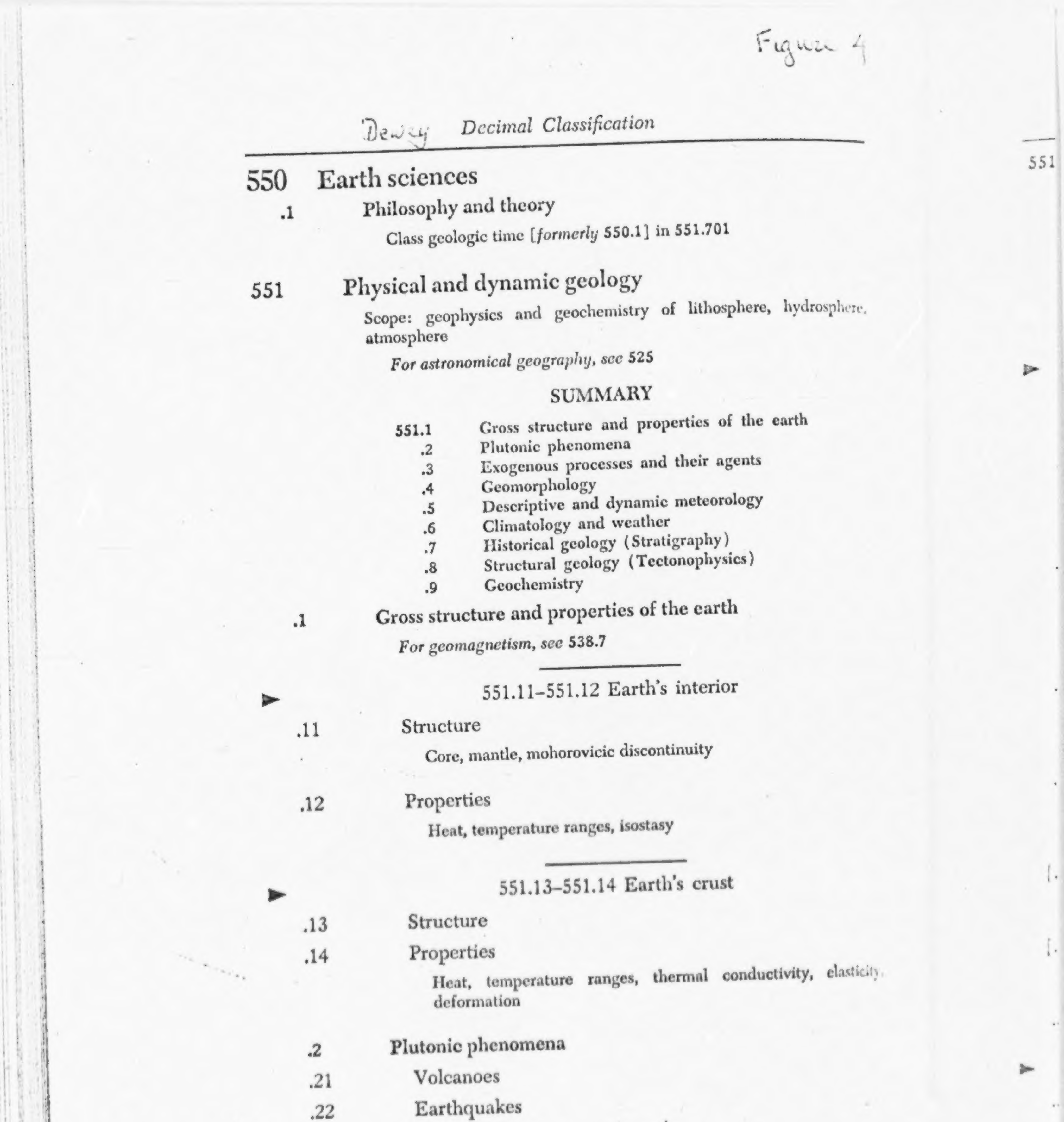


Figure 4

550 Earth sciences

.1 Philosophy and theory

Class geologic time [*formerly* 550.1] in 551.701

551 Physical and dynamic geology

Scope: geophysics and geochemistry of lithosphere, hydrosphere, atmosphere

For astronomical geography, see 525

SUMMARY

551.1	Gross structure and properties of the earth
.2	Plutonic phenomena
.3	Exogenous processes and their agents
.4	Geomorphology
.5	Descriptive and dynamic meteorology
.6	Climatology and weather
.7	Historical geology (Stratigraphy)
.8	Structural geology (Tectonophysics)
.9	Geochemistry

.1 Gross structure and properties of the earth

For geomagnetism, see 538.7

▶ 551.11–551.12 Earth's interior

.11 Structure

Core, mantle, mohorovicic discontinuity

.12 Properties

Heat, temperature ranges, isostasy

▶ 551.13–551.14 Earth's crust

.13 Structure

.14 Properties

Heat, temperature ranges, thermal conductivity, elasticity, deformation

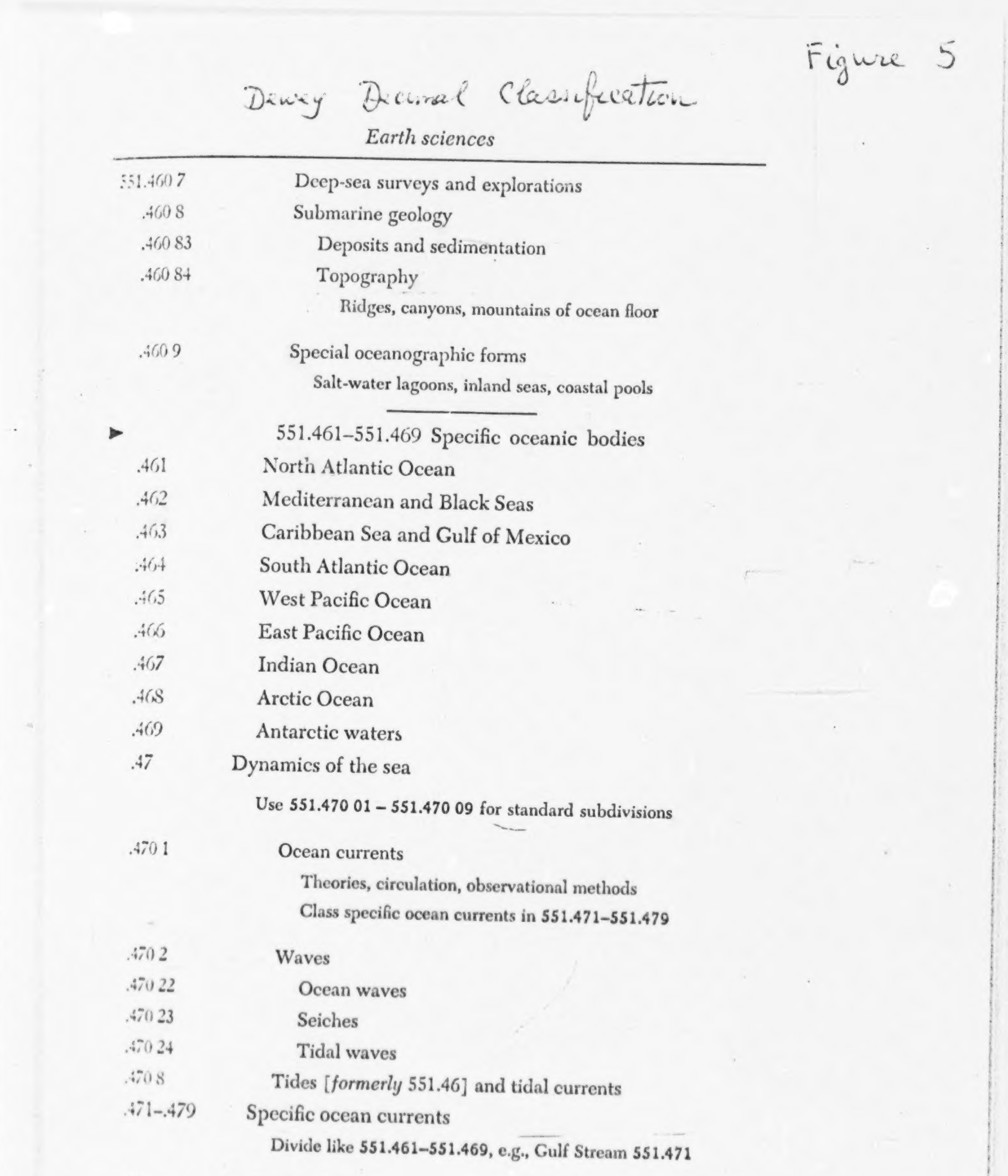
.2 Plutonic phenomena

.21 Volcanoes

.22 Earthquakes

.23 Fumaroles, hot springs, geysers

Figure 5



Dewey Decimal Classification

551.460 7	Deep-sea surveys and explorations
.460 8	Submarine geology
.460 83	Deposits and sedimentation
.460 84	Topography Ridges, canyons, mountains of ocean floor
.460 9	Special oceanographic forms Salt-water lagoons, inland seas, coastal pools
►	551.461–551.469 Specific oceanic bodies
.461	North Atlantic Ocean
.462	Mediterranean and Black Seas
.463	Caribbean Sea and Gulf of Mexico
.464	South Atlantic Ocean
.465	West Pacific Ocean
.466	East Pacific Ocean
.467	Indian Ocean
.468	Arctic Ocean
.469	Antarctic waters
.47	Dynamics of the sea Use 551.470 01 – 551.470 09 for standard subdivisions
.470 1	Ocean currents Theories, circulation, observational methods Class specific ocean currents in 551.471–551.479
.470 2	Waves
.470 22	Ocean waves
.470 23	Seiches
.470 24	Tidal waves
.470 8	Tides [*formerly* 551.46] and tidal currents
.471–.479	Specific ocean currents Divide like 551.461–551.469, e.g., Gulf Stream 551.471
.48	Surface waters
.482	Lakes, ponds, fresh-water lagoons

UDC

66 Chemical Industry. Chemical Technology

Figure 6

66-2/-8	*As* 621-2/-8 *plant, process, product details*
-4	Shape and form of products
-5	Plant operation and control
-7	Plant servicing, safety, etc.
-9	Process and plant characteristics
-932	Continuous processes
-934	Discontinuous, intermittent, batch
-944	Counterflow processes
-951	Simple (one-stage) processes
-954	Complex (multi-stage) processes
-97	Thermal: temperature level or range
-973/-974	Very low. Low temperature
-975-/976	Normal (atmospheric). Moderate temp.
-977/-978	High temperature. Very high
-98	Pressure level or range. *As* -97
-982	Vacuum
66.0	CHEMICAL ENGINEERING Operations, (unit) processes and plant
66.01	Engineering, processing, plant and services
.011	Process design
.012	Process control and efficiency. *Cf.* 658.5
.2	Consumption of raw and auxiliary materials
.3	Heat and power consumption
.4	Capacity. Throughput
.5	Yield. Output
.7	Process efficiency, engineering economics
.013	Chemical works: plant, power, services
.6/.7	Power supply. Processing services
.017	Material properties. *Cf.* 620.1/.2
.019	Material defects, spoilage, etc. *As* 620.19
66.02	Chemical processes and plant generally
.022	Pre-treatment, preparation. *By* :621.9
.023	Containers. Reaction vessels. *By* :621.642
.024	Mountings. Stands. Supports, etc.
.025	Fittings for vessels. Closures and seals. Manholes and windows. Inlets. Outlets
.026	Pipes, valves, connections. *By* :621.64
.028	Introduction of material. Correct quantities
66.03	Plant, processes for specific industries (*at* 664, 666, 667, *etc.*)
66.04	Heat transfer treatments. Furnaces. *Cf.* 662.9
.041	Furnaces
.042	Furnace operation and equipment. Charging
.043	Furnace materials. Linings
.044	Furnace upkeep and repair
.045	Heat transfer, exchangers and coolers

66.046	Thermal processing and plant
.3	Cooling processes. *Cf.* 621-71
.4	Heating of solids. Roasting, calcination
.5	Fusion. Melting. Smelting
.8	Pressure heating. Autoclave treatment
.047	Drying: air (vacuum, freeze) drying
.3	High-temp. drying (heat alone)
.35	Radiation (high-frequency, infra-red)
.8	Chemical drying. Desiccation
.048	Distillation, fractionation: stills, columns
.3	Fractional distillation. Fractionation
.5	Vacuum distillation or evaporation
.6	Steam distillation
.7	Pressure distillation
.8	Molecular distillation
.9	Products, stages: tops, middles, bottoms
.049	Other thermal methods of separation
.1	Concentration by evaporation
.2	Solid separation by distillation of solution
.4	Phase separation by partial fusion.
.5	Solid/liquid separation. Sweating
.6	Sublimation
66.05	Plant, processes for specific industries (*at* 664, 666, 667, *etc.*)
66.06	Working with liquids: handling, treatment
.061	Solution. Extraction
.4	From solids
.5	From liquids. Liquid-liquid extraction
.062	Solvents. *By* :546 *and* :547
.063	Mixing. Maceration. Homogenization
.6	Dispersions: Emulsification, etc.
.72	Softening, plasticizers, etc.
.93	Dilution and diluents
.064	Dialysis. Dialysers
.065	Solidification. Precipitation. Crystallization
.5	Crystallization
.066	Clarification. Decantation. Separation
.067	Refining. Purification. Filtration
.3	Filter apparatus: papers, funnels, etc.
.4	Pressure filtration. Filter presses
.5	Centrifuging. Centrifuges
.7	Decolorizing. Deodorizing
.068	Expressing. Presses
.069.1	Washing
.82	Treatment of liquids with gases. Gasification
.84	Degassing of liquids. Degasification

UDC Figure 7

669	METALLURGY. *Cf.* 622.7; 661.8
..5/..8	Specific metal alloys, etc.
	As 669.2/.8...5/8
-1	State and form of the metal(s)
-11	Natural state
-12/-13	Rolled, drawn, extruded. Forged, pressed
-14/-15	Cast. Heat treated, hardened
-4	Shape and form of metal products. *As* 621-4
-9	Process and plant characteristics. *As* 66-9
669.01	General and theoretical metallurgy
.014	Reactions. Behaviour of elements, etc.
.015	Products (intermediate, crude, pure)
.017	Physical metallurgy generally. *Cf.* 620.18
.018	Alloys. Metals according to properties.
	Cf. 669.2/.8..5
.2	Mechanical: machinable, deformable
.25	Extra-hard metals, hard metals
.29	Structural, constructional
.4	Thermal: m.pt., expansion, etc.
.5	Electrical and magnetic properties
.6	Acoustic, optical, density properties
.7/.8	Chemical. Corrosion-resistant
.9	Pseudo-alloys generally. Cer(a)mets
669.04	Heating processes, equipment. *As* 66.04, *e.g.*
.041	Metallurgical furnaces. *Cf.* 669.162.2
.042	Furnace accessories, charging devices, etc.
.046	Heating processes
.5	Melting: oxidation, carburization, etc.
669.05	General, fundamental metallurgical processes
.051	Combined studies on ores and metallurgy
.052	Treatment of mixed ores. *Cf.* 622.7
.053	Metal extraction. *Cf.* 669.2/.8..3
.054	Metal refining generally. *Cf.* 669.2/.8...4
.8	Recovery from scrap and waste products
.056	Metal fabrication generally. *By* :621.7/.9
	Specific metals, use 669...6
.9	Coating, finishes on metal. *Cf.* 669...69
.058	Metal plating(s) generally. *Cf.* 669...8
• .083	Pressure treatments, vacuum metallurgy: *use* 669-98 •
669.09	Various metallurgical processes. *As* 66.09
669.1	FERROUS METALS. IRON. STEEL
.11	Iron and iron-carbon alloys
.12	Pure iron (chemically and technically pure)
669.13	**Cast iron**
.018	According to properties. *As* 669.018
.138	Coating(s). *As* 669.2/.8...8
669.14	**Steel generally. Carbon steels**
.018	According to properties. *As* 669.018
.148	Coating(s). *As* 669.2/.8...8
669.15	**Alloys of iron (except with carbon).**
	Alloy steels (-194). Ferro-alloys (-198)
	Elements by '2/'8 *as* 669.2/.8, *e.g.*
	669.15'24-194 Nickel steel
	-198 Ferro-nickel
	'24'26 Nickel-chromium steel

Bliss Classification

Figure 8

CLASS D

ASTRONOMY, GEOLOGY, GEOGRAPHY, AND NATURAL HISTORY

SECTIONS

D1 - D9, assigned to Astronomy, are consistent with Schedule 1.

D	General, Elementary.
DA	General, Descriptive, and Spherical Astronomy.
DB	Practical, and Observational, Astronomy.
DC	Theoretical Astronomy.
	Celestial Mechanics.
DD	Cosmology, Astrophysics, and the Stars.
	Nebulae, Meteors, and Comets.
DE	The Sun.
DF	Planets, the Solar System.
DG	Geology, General:
	Elementary, Astronomical relations, Geognosy.
DH	Physical Geology:
	Geochemistry.
	Dynamical Geology.
DI	Historical Geology:
	Paleontological Geology.
	Stratigraphical Geology.
DJ	Mesozoic and Cenozoic Eras.
DK	Physiographical Geology.
DL	Geographical Geology.
DM	Geology of the United States.
DN	Petrology and Petrography.
DO	Economic Geology.
DP	Economic Geology of the United States (or of America).
DQ	Geography, General.
	Mathematical and Cartographical.
DR	Physical Geography (Physiography).
DS	Meteorology.
DT	Regional Geography.
DU	Natural History.
DV	Natural History of the Several Countries.
DW	Microscopy.
DY	Geology and Biology.

Bliss Classification

Figure 9

SCHEDULE 11

FOR SUB-CLASSIFICATION UNDER ANY BOTANIC CLASS, ORDER, FAMILY, OR GENUS, THIS SPECIAL AUXILIARY SCHEDULE

may be requisite, entire or in part— more often under the higher taxononic classes, to which its specifications are more readily applicable, than under the lower classes, to which, however, some of its subdivisions may be adapted. The letters for the specifications of this schedule, whether applied under sections or under sub-sections, should be prefixed by the component comma, to distinguish these from ordinary subdivisions of sub-sections, as is done elsewhere to indicate specification from a relevant systematic schedule. This composite sub-classification would be antecedent to the taxononic subdivisions.

The numeral subdivisons would be consistent with Schedule 1.

,A	Morphology, Anatomy, and Histology.
,B	Special, Distinctive, Peculiar Organs, Structures, or Tissues. Transformations.
,C	Roots, Root-systems, of Cormophytes (vascular plants); or Mycelium of Thallophyta.
,D	Stems, or analogous, or homologous, structures.
,E	Leaves, Foliage, Venation, Phyllotaxis. Modified Leaves, Fronds, Thallus, or analogous, or homologous, structures.
,F	Reproduction, Reproductive Organs, Sexual, or Asexual. Flowers, Floral Parts, Inflorescence. Antheridia, Oögonia, Archegonia; or analogous, or homologous structures.
,G	Fruits, and Seeds; or Spores, and Sporangia.
,H	Embryology of the class, or order, etc.
,I	Physiology " " " " " Chemical composition, properties, actions, etc. Metabolism, Growth, Duration of life, etc.
,J	Food, Assimilates, Commensalism, etc.
,K	Special Physiology: special Processes, Functions, Reactions; Habits, Tropisms, etc.
,L	Secretions, Excretions, Extracts, Special substances, or Products.
,M	Ecology of the class, or order, etc.
,N	Special Ecological subjects: Photographic studies. Relations to Humidity, to Light, etc. Temperature-range, and other Relations to Temperature.
,O	Ecological Adaptation, Variation, and Isolation. See also Geographical Adaptation, Isolation, ,S.

Bliss Classification

Figure 10

EN Genetics: Inheritance (Heredity) and Variation.

The science of inheritance and variation in organisms, Genetics, is distinct, tho rooted in Cytology (EC), which is basic not only to Genetics but also to Histology, Development, and Embryology, and not only to those branches of Morphology, but to the interrelated branches of Physiology. Genetics on the other hand extends into Phylogeny, EO. Cytology and Genetics, or Genetics with especial regard to Cytology, may be placed in EN, or in END. Genetics and Phylogeny would be distinct in ENY. Ontogeny is in EDE, Morphogenesis in EDH.

EN1 - EN9 should be consistent with Schedule 1.

EN8 Problems of, or in, Genetics.

ENA Theoretical, Comprehensive works and general discussions.
Principles, Theories, Laws of Inheritance and Variation.
Inheritance and Variation in relation to Development.
See also Ontogeny, EDE, and Variation, ENG.

ENB Experimental studies:
Methods,
Laboratories, Stations.

ENC Statistical and Biometrical studies.
Mathematical treatment.
Probability in.
See also Biometrics, EBR, Statistical Biophysics, EAR. and Statistical Methods in Biology, E89.

END Genetics including Cytology. *(If this is to be distinguished from the general subject)*

ENE Cytological Basis of Genetics.
Germ-cells, Gametes, Sexual cells.
Germ-plasm,
Continuity of;
Weismann's theory of, Weismannism.
Genotypes.
Fertilization.
Spermatogenesis, and Oögenesis; Zygotes.
Nucleus, Karyology;
Maturation.
See the alternative under Cytology, ECO - ECR.
See also Reproduction and Sex, EKR and EKS, under Physiology.

ENF Chromosomes, Chromosomology.
Chromatin, Chromomeres;
Chromosome Changes: Inversion, Translocations, Deficiency.
Chromosome theory of Inheritance;
Genes, The;
Chromosome numbers:
Haploid, Diploid, Triploid, Tetraploid;
Ploidy, Polyploidy, Heteroploidy.

ENG Variation, Genetic; Diversity. See also FAD, FKB, GKB.
Causes, Factors;
Hereditary Differences;
Autogenous Variations in Gametes, in Somatic Tissues.
Gene Mutations.
Ecological, Adaptive Variations see under Adaptation, ELT and EMJ.
But for Gene Mutations see rather ENP.
Racial Variability, Races:
Racial Genotypes,
Genetic Equilibrium,
Hardy's Formula.
See also EOG.
Extinction of Races.

ENH Isolation, Genetic.
Sexual Selection,
Physiological, and Psychological, Incompatibility.
Isolating Mechanisms.
Phylogenetic Isolation see in EOI,
Ecological Isolation in EMI.

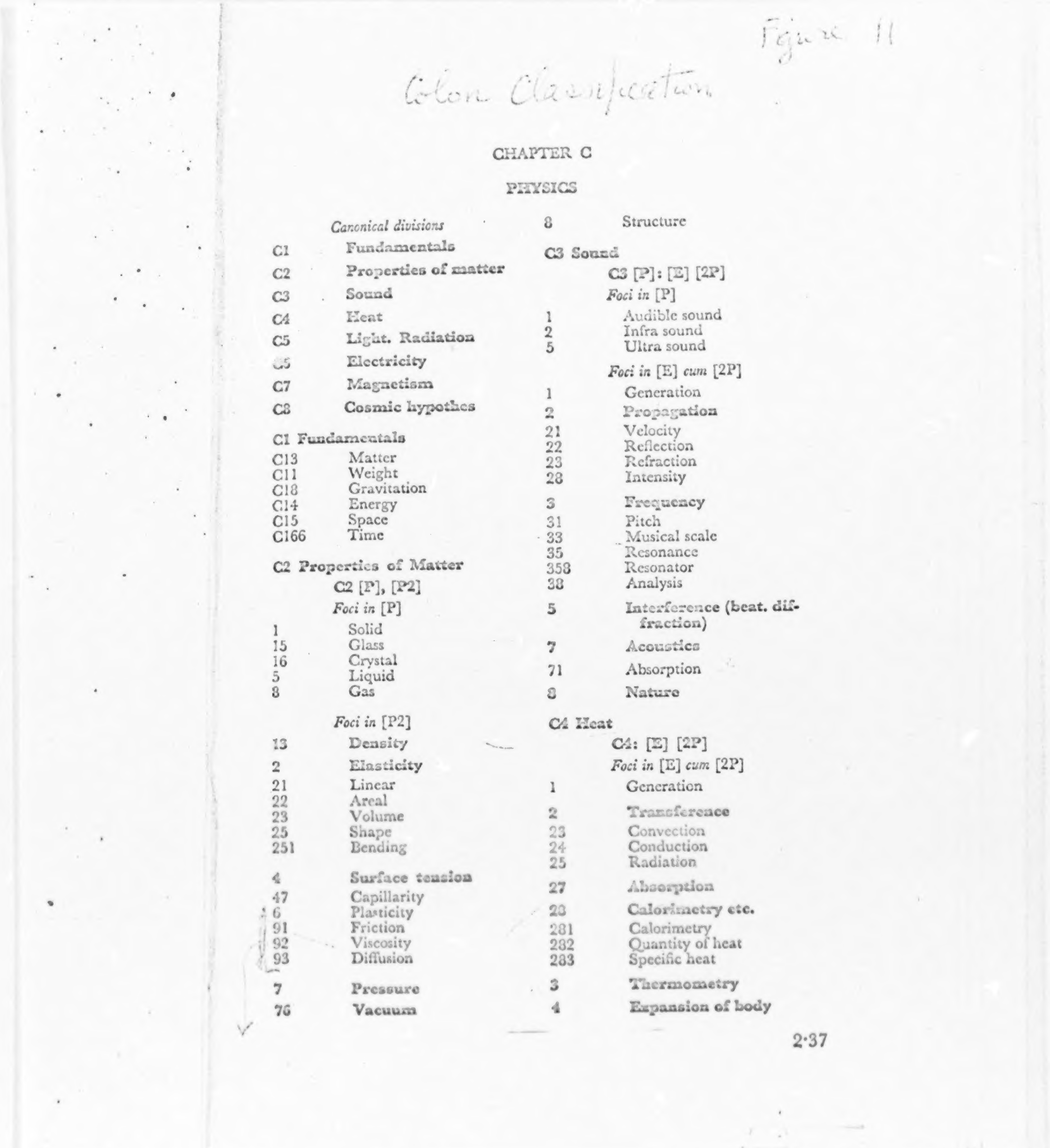


Figure 11

Colon Classification

CHAPTER C

PHYSICS

Canonical divisions

C1	**Fundamentals**
C2	**Properties of matter**
C3	**Sound**
C4	**Heat**
C5	**Light. Radiation**
C6	**Electricity**
C7	**Magnetism**
C8	**Cosmic hypothes**

C1 Fundamentals

C13	Matter
C11	Weight
C18	Gravitation
C14	Energy
C15	Space
C166	Time

C2 Properties of Matter

C2 [P], [P2]

Foci in [P]

1	Solid
15	Glass
16	Crystal
5	Liquid
8	Gas

Foci in [P2]

13	**Density**
2	**Elasticity**
21	Linear
22	Areal
23	Volume
25	Shape
251	Bending
4	**Surface tension**
47	Capillarity
6	Plasticity
91	Friction
92	Viscosity
93	Diffusion
7	**Pressure**
76	**Vacuum**
8	Structure

C3 Sound

C3 [P]: [E] [2P]

Foci in [P]

1	Audible sound
2	Infra sound
5	Ultra sound

Foci in [E] *cum* [2P]

1	Generation
2	**Propagation**
21	Velocity
22	Reflection
23	Refraction
28	Intensity
3	**Frequency**
31	Pitch
33	Musical scale
35	Resonance
358	Resonator
38	Analysis
5	**Interference (beat. diffraction)**
7	**Acoustics**
71	Absorption
8	**Nature**

C4 Heat

C4: [E] [2P]

Foci in [E] *cum* [2P]

1	Generation
2	**Transference**
23	Convection
24	Conduction
25	Radiation
27	**Absorption**
28	**Calorimetry etc.**
281	Calorimetry
282	Quantity of heat
283	Specific heat
3	**Thermometry**
4	**Expansion of body**

2·37

Subject heading list Figure 12

AVIATION SUBJECT HEADINGS

Aerodynamics, Hypersonic
sa Aerodynamics, Supersonic
xx Aerodynamics, Supersonic

Aerodynamics, Supersonic
sa Aerodynamics, Hypersonic
Aerodynamics, Transonic
Shock waves
xx Aerodynamics, Hypersonic
Aerodynamics, Transonic

Aerodynamics, Transonic
sa Aerodynamics, Supersonic
xx Aerodynamics, Supersonic

Aerolasticity
—Electromechanical analogies
xx Electromechanical analogies

Aerographs. *See* **Meteorographs.**

Aeronautical Center. *See* **U.S. Federal Aviation Agency. Aeronautical Center.**

Aeronautical charts. *See* **Cartography; Maps and charts.**

Aeronautical engineering
xx Engineering

Aeronautical engineers
sa Flight engineers
xx Engineers
Flight engineers
—Training
xx Training

Aeronautical instruments. *See* **Instruments.**

Aeronautical research. *See* **Aeronautics—Research.**

Aeronautics [For general material on the science of aeronautics]
sa Aerodynamics
Airplanes
Civil aviation
Flight
Rockets
xx Aviation
x High-speed aeronautics
—Abbreviations. *See* **Abbreviations.**
—Addresses, essays, etc.
—Alaska
—Bibliog. *See* **Bibliography.**
—Biog. *See* **Biography.**

Aeronautics ***(Continued)***
—Canada
—Competions. *See* **Competitions.**
—Directories
—Education. *See* **Study and teaching.**
—Examinations, question, etc.
—Exhibitions. *See* **Exhibitions.**
—Fiction
x Fiction
Military aviation—Fiction
Military aviation—Korean War—Fiction
Military aviation—World War, 2d—Fiction
—Gt. Brit.
—Handbooks, manuals, etc. *See* **Handbooks, manuals, etc.**
—History. *See* **History.**
—Manuals
—Nomenclature. *See* **Terminology.**
—Outlines, syllabi, etc.
—Pictorial works
—Periodicals
xx Periodicals
—Bibliography
—Indexes
xx Indexes
—Poetry
—Research
xx Research
x Aeronautical research
—Societies. *See* **Organizations.**
—Statistics
—Terminology. *See* **Terminology.**
—Textbooks
xx Education
x Textbooks
—U.S.

Aeronautics, Commercial. *See* **Commercial aviation.**

Aeronautics, Military. *See* **Military aviation.**

Aeronautics and civilization

Aeronautics and state
sa Administrative and political divisions
State aeronautics
—U.S.

Aeronautics as a profession. *See* **Occupations.**

Aeronautics in agriculture. *See* **Agriculture.**

Figure 13

Chemical detection (Con.)
excludes Chemical agent detection
BT Detection
RT Naval mine detection
—Ordnance detectors
Sea surface effects detection
—Submarine detection

Chemical determination
USE Chemical analysis

Chemical dosimeters 0618
BT Dosimeters
Measuring instruments
Radiation measuring instruments
RT Luminescent dosimeters

Chemical element 104
USE Element 104

Chemical elements 0702
Use of a more specific term is recommended; consult the terms listed below
Actinide series
Alkali metals
Alkaline earth metals
Atoms
Halogens
Ions
Isotopes
Metalloids
Metals
Nonmetals
Precious metals
Rare earth elements
Rare gases
Refractory metals
Trace elements
Transition metals
Transuranium elements
Valence

Chemical engineering 0701
UF Unit operations
RT Agricultural chemistry
Chemurgy
Colloid chemistry
Electrochemistry
—Materials handling
Organic chemistry
—Physical chemistry
Thermochemistry

Chemical engineers 0509
BT Engineers
Personnel
Professional personnel

Chemical equilibrium 0704
UF Equilibrium constants
NT Acid-base equilibrium
RT—Chemical reactions
Chemical reactivity
Fugacity
Irreversible processes
Phase rule
Reaction kinetics
Thermodynamic equilibrium

Chemical etching 1308 0701
BT Chemical finishing
Etching
Metal finishing

Chemical exchange isotope separation 1802
BT Isotope separation
Separation
NT Isotope exchange
RT—Centrifuging
—Distillation
Thermal diffusion

Chemical finishing 1308 0701
UF Chemical coating
BT Metal finishing
NT Chemical etching
—Chemical polishing
Electropolishing
RT Conversion coating
—Corrosion prevention

Chemical hydroforming 0701
BT Chemical reactions
Hydrogenation
RT—Cyclization
Dehydrogenation
—Oxidation

Chemical indicators 1103
UF Indicators (chemical)
Phenolphthalein
RT Carminic acid
Congo red
Hematoxylin
Methylene blue
Methyl violet
Phloroglucinol

Chemical industry 0503 0701
BT Industries
NT Drug industry
RT Munitions industry

Chemical kinetics
USE Reaction kinetics

Chemical laboratories 1402
UF †CBR laboratories
BT Laboratories

Chemical lasers 2005
BT Lasers
Stimulated emission devices

Chemical machining 1308 0701
UF Chemical milling

Chemical marking agents 1502
RT—Dyes

Chemical milling
USE Chemical machining

Chemical plants 0701
BT Industrial plants

Chemical polishing 1308 0701
BT Chemical finishing
Metal finishing
Polishing
NT Electropolishing
RT—Chemical cleaning

Chemical porcelain 1102
BT Porcelain
Refractory materials
Vitreous whitewares
Whitewares
RT—Electrical porcelain
Refractory porcelain

Chemical projectiles 1502
BT Chemical ammunition
Projectiles
RT Chemical warheads

Chemical properties 0704
NT Acidity
Alkalinity
Calorific value
Chemical reactivity
Chlorinity
Heat of ablation
Heat of absorption
Heat of activation
Heat of adsorption
Heat of combustion
Heat of crystallization
Heat of dissociation
—Heat of formation
Heat of fusion
Heat of hydration
Heat of mixing
—Heat of reaction
Heat of solution
Heat of sublimation
Heat of transformation
Heat of vaporization
—Latent heat
pH
Salinity
—Thermochemical properties
Valence
RT Adsorptivity
—Atomic properties
—Chemical bonds
—Chemical tests
Chromaticity
Hygroscopicity
—Mechanical properties
Molecular weight
Optical activity
Passivity
—Physical chemistry
Physicochemical properties
—Soil properties
Solubility
—Thermodynamic properties
Toxicity

Chemical propulsion 2108
RT Hybrid propulsion
Jet propulsion
—Marine propulsion
Missile propulsion
Rocket propulsion
Spacecraft propulsion

Chemical pulping 0701 1308
BT Pulping
NT Continuous pulping
Sulfate pulping
Sulfite pulping
RT—Cooking liquors (pulping)
Digestion (decomposition)

Chemical pulps 1112 1107
BT Pulps
NT Dissolving pulps
Rag pulp
Sulfate pulps
Sulfite pulps
RT Cellulose
Wood pulp

Chemical radicals 0704
NT Complex ions
—Free radicals
RT—Ions
—Molecules
Valence

Chemical reactions 0704
UF Chemical synthesis
NT Acetylation
Acidolysis
—Acylation
Addition polymerization
—Addition reactions
Alcoholysis
Alkali aggregate reactions
—Alkylation
Amidation
Amination
Ammonolysis
Bromination
Carbonylation
Carboxylation
—Cement aggregate reactions
Chelation
Chemical hydroforming
—Chlorination
Condensation polymerization
—Condensation reactions
—Cyclization
Dealkylation
Decarboxylation
Dechlorination
—Decomposition reactions
Defluorination
Dehydrohalogenation
Denitration
Depolymerization
Desulfurization
Diazotization
Diels–Alder reactions
Diene synthesis
Dimerization
Displacement reactions
Dissociation
Electrolysis
Electrophilic reactions
Elimination reactions
Endothermic reactions
Esterification
Etherification
Ethylation
Exchange reactions
Exothermic reactions
Fermentation
—Fluorination
Gas ionization
Glycolysis
Graft polymerization
Grignard reactions
—Halogenation
Hydration
Hydrochlorination
Hydrofluorination
—Hydrogenation
—Hydrolysis
Internal oxidation
Iodination
—Ionization
Isomerization
Metalation
Methylation
Nitration
Nitrification
Nitrogen fixation
Nucleophilic reactions
—Oxidation
Oxidation reduction reactions
Ozonization
Phosphorylation
—Photochemical reactions
Photochromism
Photolysis
Photosynthesis
—Polymerization
Pyrohydrolysis
Pyrolysis
Radiolysis
Rearrangement reactions
Recombination reactions
Reduction (chemistry)
Saponification
—Solvolysis
—Substitution reactions
Sulfation
Sulfonation
Sulfuration
Xanthation
RT Accelerating (chemistry)
Activity coefficients
Arresting (process)
Carbonization
Catalysis
—Chemical equilibrium
Chemical reactivity
Chemical reactors
Chemical stabilization
Conversion
—Cracking process
Dehydration
Deuteration
Disproportionation
Heat of activation
—Heat of reaction
Inorganic chemistry
Neutralizing
Organic chemistry
—Particle interactions
—Physical chemistry
Reaction kinetics
Slaking
Stoichiometry
Sulfidization
Thermochemistry

Chemical reactivity 0704
BT Chemical properties
Reactivity
RT Atomic structure
—Chemical equilibrium
—Chemical reactions
Free energy
Heat of activation
—Heat of reaction
Molecular structure
Reaction kinetics
Thermochemistry
Valence

Chemical reactors 0701
RT Autoclaves
Beds (process engineering)
—Burners
—Chemical reactions
Chlorinators
Columns (process engineering)
Contactors
—Containers
Copper converters
Digesters
Fluidized bed processors
—Furnaces
Kettles
Kilns
Retorts (reactors)
Roasters
—Steel converters
—Tanks (containers)

Chemical reducing
USE Reduction (chemistry)

Chemical removal (sewage treatment) 1302
BT Sewage treatment
Waste treatment
RT Activated carbon treatment
Activated sludge process
Aerobic processes
Anaerobic processes
Clarification
—Filtration
Microorganism control (sewage)
—Odor control
—Sedimentation

Chemical removal (water treatment) 1302
BT Water treatment
RT Activated carbon treatment
Adsorption
—Chlorination
Clarification
Deaeration
Demineralizing
—Filtration
—Ion exchanging
Lime–soda ash process
—Water softening

Chemical resistance 1113
NT Acid resistance
RT—Corrosion resistance
Oil resistance
Solvent resistance

Chemical resistant coatings 1103
BT Coatings
Protective coatings

1903 (Con.)
- Antiship torpedoes
- Antisubmarine minefields
- Antisubmarine missiles
- Antisubmarine weapon projectors
- Antisubmarine weapons
- Bottom mines
- Contact mines
- Depth bombs
- Depth charge boosters
- Depth charges
- Exercise heads
- Floating mines
- Homing torpedoes
- Influence mines
- Limpet mines
- Magnetic mines
- Mine anchors
- Mine batteries
- Mine boosters
- Mine buoys
- Mine cables
- Mine cases
- Mine components
- Mine countermeasures
- Mine delay mechanisms
- Minefield gap
- Minefield lanes
- Minefield markers
- Minefields
- Mine floats
- Mine markers
- Mine neutralization
- Mine parachutes
- Mine release mechanisms
- Mines (ordnance)
- Mine simulation
- Mine sterilizers
- Moored mines
- Naval mines
- Offensive minefields
- Oscillating mines
- Pattern running torpedoes
- Pressure mines
- Riverine mines
- Rocket assisted torpedoes
- Shallow water mines
- Ship counter devices
- Ship launched torpedoes
- Straight running torpedoes
- Submarine launched torpedoes
- Torpedo batteries
- Torpedo boosters
- Torpedo components
- Torpedo controls
- Torpedo countermeasures
- Torpedo data computers
- Torpedo engines
- Torpedoes
- Torpedo exploder mechanisms
- Torpedo guidance
- Torpedo launchers
- Torpedo launching
- Torpedo tubes
- Torpedo warheads
- Underwater ordnance
- Underwater projectiles
- Underwater rockets
- Underwater to underwater missiles
- Wire guided torpedoes

2000
Physics

2001
Acoustics
- Acoustic absorption
- Acoustic fields
- Acoustic filters
- Acoustic impedance
- Acoustic insulation
- Acoustic measurement
- Acoustic properties
- Acoustic receivers
- Acoustic refraction
- Acoustic resonance
- Acoustic resonators
- Acoustics
- Acoustic scattering
- Acoustic signals
- Acoustic velocity
- Aerodynamic noise
- Aircraft noise
- Aircraft propeller noise
- Ambient noise
- Antinodes
- Audio frequencies
- Bandpass filters
- Bandstop filters
- Bells
- Cavitation noise
- Coherent acoustic radiation
- Compressor noise
- Doppler effect
- Echoes
- Elastic waves
- Engine noise
- Gear noise
- High pass filters
- Horns
- Hydrophone arrays
- Hydrophones
- Input impedance
- Jet aircraft noise
- Jet engine noise
- Lamb waves
- Low pass filters
- Marine biological noise
- Marine propeller noise
- Mechanical waves
- Motor noise
- Mufflers
- Nodes (standing waves)
- Noise (sound)
- Noise reduction
- Phonons
- Pitch (frequency)
- Radiation pressure
- Random noise
- Reverberation
- Rocket engine noise
- Ship noise
- Shock waves
- Silencers
- Sirens
- Sonar background noise
- Sonar self noise
- Sonic boom
- Sound generators
- Sound pressure
- Sound systems
- Sound transducers
- Sound transmission
- Sound waves
- Stereophonic sound
- Submarine noise
- Surface waves
- Torpedo noise
- Tuning forks
- Ultrasonic frequencies
- Ultrasonic radiation
- Underwater acoustics
- Underwater ambient noise
- Underwater sound equipment
- Underwater sound reverberation
- Underwater sound sources
- Underwater sound transmission

2002
Crystallography
- Acicular structure
- Allotropy
- Anisotropy
- Asterism
- Banded structure
- Basal plane
- Base centered monoclinic lattices
- Base centered orthorhombic lattices
- Bicrystals
- Body centered cubic lattices
- Body centered orthorhombic lattices
- Body centered tetragonal lattices
- Bragg angle
- Brillouin zones
- Close packed lattices
- Color centers
- Columnar structure
- Crystal defects
- Crystal dislocations
- Crystal growth
- Crystal lattices
- Crystallites
- Crystallization
- Crystallography
- Crystals
- Crystal structure
- Crystal substructure
- Crystal symmetry
- Czochralski method
- Dendritic crystals
- Dendritic powder
- Edge dislocations
- Elongated structure
- Epitaxy
- Etched crystals
- Excitons
- Face centered cubic lattices
- Face centered orthorhombic lattices
- Ferroelectric crystals
- Free surfaces (crystallography)
- Frenkel defects
- Grain size
- Grain structure
- Hexagonal close packed lattices
- Hexagonal lattices
- Interstitials
- Ionic crystals
- Isotropy
- Lattice parameters
- Lattice vibrations
- Metal crystals
- Metal whiskers
- Microstructure
- Monoclinic lattices
- Optical anisotropy
- Orthorhombic lattices
- Piezoelectric crystals
- Pleochroism
- Point defects
- Polycrystalline
- Polycrystals
- Preferred orientation
- Schottky defects
- Screw dislocations
- Simple cubic lattices
- Single crystals
- Spherulites
- Spin lattice relaxation
- Steel constituents
- Tetragonal lattices
- Triclinic lattices
- Trigonal lattices
- Twinning
- Vacancies (crystal defects)
- Verneuil process
- Whiskers (single crystals)
- Widmanstatten structure

2003
Electricity and Magnetism
- Alternating current
- Anodic polarization
- Antiferroelectricity
- Antiferromagnetism
- Avalanche breakdown
- Barkhausen effect
- Capacitance
- Capacitive reactance
- Carbon arcs
- Cathodic polarization
- Characteristic impedance
- Charge density
- Coercive force
- Coherent electromagnetic radiation
- Core loss
- Coronas
- Coulomb friction
- Curie temperature
- Current density
- Current efficiency
- Cyclotron waves
- Degaussing
- De Haas-Van Alphen effect
- Demagnetization
- Diamagnetism
- Dielectric breakdown
- Dielectric films
- Dielectric properties
- Dielectrics
- Dipole moments
- Dipoles
- Direct current
- Dissipation factor
- Eddy currents
- Electrets
- Electrical faults
- Electrical grounding
- Electrical impedance
- Electrical phenomena
- Electrical properties
- Electrical resistance
- Electrical resistivity
- Electric arcs
- Electric charge
- Electric corona
- Electric current
- Electric discharges
- Electric double layer
- Electric fields
- Electricity
- Electric moments
- Electric potential
- Electric power demand
- Electric sparks
- Electrode potentials
- Electrodynamics
- Electrokinetics
- Electromagnetic absorption
- Electromagnetic compatibility
- Electromagnetic environments
- Electromagnetic fields
- Electromagnetic induction
- Electromagnetic interactions
- Electromagnetic properties
- Electromagnetic radiation
- Electromagnetic radiation control
- Electromagnetic theory
- Electromagnetism
- Electromagnets
- Electromechanics
- Electron paramagnetic resonance
- Electrons
- Electrooptics
- Electrostatic charge
- Electrostatics
- Electrostriction
- Ettingshausen effect
- Extra high voltage
- Far field
- Ferrimagnetic materials
- Ferrimagnetism
- Ferroelectric crystals
- Ferroelectric domains
- Ferroelectricity
- Ferroelectric materials
- Ferromagnetism
- Field emission
- Field strength
- Flashover
- Flux jumping
- Galvanomagnetic effects
- Gas discharges
- Ginzburg-Landau theory
- Glow discharges
- Gunn effect
- Hall effect
- High voltage
- Inductance
- Inductive reactance
- Insertion loss
- Insulation resistance
- Ion currents
- Ion emission
- Kerr electrooptical effect
- Kerr magnetooptical effect
- Low voltage
- Magnet coils
- Magnetic alloys
- Magnetic anisotropy
- Magnetic circuits
- Magnetic cores
- Magnetic dipoles
- Magnetic domains
- Magnetic fields
- Magnetic hysteresis
- Magnetic induction
- Magnetic materials
- Magnetic measurement
- Magnetic moments
- Magnetic permeability
- Magnetic poles
- Magnetic properties
- Magnetic relaxation
- Magnetic saturation
- Magnetization
- Magnetooptics
- Magnetoresistivity
- Magnetostatics
- Magnetostriction
- Magnets
- Magnet wire
- Meissner effect
- Mutual inductance
- Neel temperature
- Nernst effect
- Overcurrent
- Overvoltage
- Paramagnetic materials
- Paramagnetic relaxation
- Paramagnetic resonance
- Paramagnetism
- Peltier effect
- Permanent magnets
- Persistent currents
- Photoelectrets
- Photoelectric cross sections
- Photoelectric emission

Thesaurus of Engineering and Scientific Terms

Figure 13

Cells (biology) (Con.)
. . Erythrocytes
. . Leukocytes
. . . Eosinophils
. . . Lymphocytes
. Germ cells
. Nerve cells
. Phagocytes
. Plant cells

Cellulosic resins
. Cellulose esters
. . Cellulose acetate
. . Cellulose nitrate
. . Cellulose xanthate
. Cellulose ethers
. . Carboxymethyl cellulose
. . Ethyl cellulose
. . Hydroxyethyl cellulose
. . Methyl cellulose

Cements
. Bituminous cements
. Ceramic cements
. . Acid bonded reaction cements
. . Gel cements (precipitation)
. . Hydraulic cements
. . . Aluminate cements
. . . Gypsum cements
. . . Lime cements
. . . Portland cements
. . . . Air entraining cements
. . . . Expanding cements
. . . . High early-strength cements
. . . . Low heat cements
. . . . Portland cement type 1
. . . . Portland cement type 2
. . . . Portland pozzolan cements
. . . . Portland slag cements
. . . . Sulfate resisting cements
. . . . White portland cements
. . . Slag cements
. . Oil well cements
. . Saturated salt cements
. . Silicate cements
. Masonry cements
. Resin cements

Central nervous system
. Brain
. . Brain stem
. . Cerebellum
. . Cerebral cortex
. . Cerebrum
. . Cingulate gyrus
. . Limbic system
. . . Amygdala
. . . Hippocampus
. . . Hypothalamus
. . . Thalamus
. . Reticular activating system
. Diencephalon

Ceramics
. Ceramic pipes
. . Vitreous clay pipes
. Pottery
. . Chinaware
. . Earthenware
. Refractories
. . Acid refractories
. . . Silicate refractories
. . . . Fireclay refractories
. . Basic refractories
. . . Magnesite refractories
. . Firebrick
. . Neutral refractories
. . . Bituminous bonded refractories
. . . Carbon refractories
. . Refractory concretes
. . . Castable refractories
. . Refractory mortars
. Structural clay products
. . Bricks
. . . Firebrick
. . . Silica brick
. . Ceramic tiles
. . . Wall tiles
. . Stoneware
. . Vitreous clay pipes
. Tiles
. . Ceramic tiles
. . . Wall tiles

Charged particles
. Anions
. Auger electrons
. Beta particles
. Cations
. Conversion electrons
. Electrons
. Muons
. Photoelectrons
. Photoprotons
. Positrons
. Stripped atoms
. . Alpha particles
. . Deuterons
. . Protons
. . Tritons

Charting
. Flow charting
. Process charting
. . Multiple activity process charting

Charts
. Control charts
. Flow charts
. Gantt charts
. Graphs (charts)
. . Cooling curves
. . Gompertz curves
. . Growth curves
. . Mollier diagrams
. . Pearl-Reed curves
. Organization charts

Chemical properties
. Acidity
. Alkalinity
. Chemical reactivity
. Chlorinity
. pH
. Salinity
. Thermochemical properties
. . Heat of ablation
. . Heat of absorption
. . Heat of activation
. . Heat of adsorption
. . Heat of crystallization
. . Heat of mixing
. . Heat of reaction
. . . Calorific value
. . . Heat of combustion
. . . Heat of dissociation
. . . Heat of formation
. . . . Heat of hydration
. . Heat of solution
. . Heat of transformation
. . Latent heat
. . . Heat of fusion
. . . Heat of sublimation
. . . Heat of vaporization
. Valence

Chemical radicals
. Free radicals
. . Complex ions

Chemical reactions
. Acylation
. . Acetylation
. Addition reactions
. . Addition polymerization
. Alkylation
. . Ethylation
. . Methylation
. Amidation
. Amination
. Carbonylation
. Carboxylation
. Cement aggregate reactions
. . Alkali aggregate reactions
. Chelation
. Condensation reactions
. . Condensation polymerization
. . Esterification
. Cyclization
. . Diels-Alder reactions
. Dealkylation
. Decarboxylation
. Dechlorination
. Decomposition reactions
. . Electrolysis
. . Fermentation
. . Glycolysis
. . Photolysis
. . Pyrolysis
. . Radiolysis
. . Solvolysis
. . . Acidolysis
. . . Alcoholysis
. . . Ammonolysis
. . . Hydrolysis
. . . . Pyrohydrolysis
. . . . Saponification
. Defluorination
. Dehydrohalogenation
. Denitration
. Depolymerization
. Desulfurization
. Diazotization
. Diene synthesis
. Dissociation
. Elimination reactions
. Endothermic reactions
. Etherification
. Exchange reactions
. Exothermic reactions
. Grignard reactions
. Halogenation
. . Bromination
. . Chlorination
. . . Hydrochlorination
. . Fluorination
. . . Hydrofluorination
. . Iodination
. Hydration
. Hydrogenation
. . Chemical hydroforming
. Internal oxidation
. Ionization
. . Gas ionization
. Isomerization
. Metalation
. Nitration
. Nitrification
. Nitrogen fixation
. Oxidation
. . Oxidation reduction reactions
. . Ozonization
. Phosphorylation
. Photochemical reactions
. . Photochromism
. . Photolysis
. . Photosynthesis
. Polymerization
. . Addition polymerization
. . Condensation polymerization
. . Dimerization
. . Graft polymerization
. Rearrangement reactions
. Recombination reactions
. Reduction (chemistry)
. Substitution reactions
. . Displacement reactions
. . Electrophilic reactions
. . Nucleophilic reactions
. Sulfation
. Sulfonation
. Sulfuration
. Xanthation

Chemical tests
. Acid resistance tests
. Chemical analysis
. . Chromatographic analysis
. . Colorimetric analysis
. . Electrophotometry
. . Fat analysis
. . Flame photometry
. . Gas analysis
. . Metallurgical analysis
. . Microanalysis
. . Qualitative analysis
. . Quantitative analysis
. . . Electrolytic analysis
. . . Gravimetric analysis
. . . Polarographic analysis
. . . Volumetric analysis
. . Radioactivation analysis
. . . Neutron activation analysis
. . Spectroscopic analysis
. . . Spectrochemical analysis
. . Vacuum fusion analysis
. . Water analysis
. Colorimetric tests
. Field corrosion tests
. Immersion tests (corrosion)
. Oxidation tests
. Pitting tests
. Salt spray tests
. Stress corrosion tests

Chlorine organic compounds
. Chlorine aliphatic compounds
. . Acetyl chloride
. . Chloroalkanes
. . . Chlorobutanes
. . . Chloroethanes
. . . Chloromethanes
. . . . Carbon tetrachloride
. . . . Chloroform
. . . Chloropropanes
. . Chlorobutadienes
. . . Chloroprene

Medical Subject Headings Figure 16

PRUE (C13)
X MALABSORPTION SYNDROME (C13)
X STEATORRHEA (C13)

PRUE, TROPICAL (C13)

PUTUM (A12)

QUALENE (D2)

quamous Bone see under TEMPORAL BONE (A2)

QUILL (B6, D4)
XU SCILLAREN (B6, D4)

quint see STRABISMUS (C11)

able Factor see FACTOR VII (D6)

TAINS AND STAINING (E5, G1)
see also related:
DYES (D8)
XR DYES (D8)

ammering see under STUTTERING (C10, F)

annum see TIN (D1)

TANOLONE (D5)
X NEODROL (D5)

apes see under EAR OSSICLES (A9)

TAPES MOBILIZATION (E4)
XR OTOSCLEROSIS (C11)

aphylocoagulase see under HYDROLASES (D5)

TAPHYLOCOCCAL INFECTIONS (C1)
see also related:
CROSS INFECTION (C1, G3)

TAPHYLOCOCCAL INFECTIONS, GASTROINTESTINAL (C1, C4)

TAPHYLOCOCCAL INFECTIONS, RESPIRATORY (C1, C5)

TAPHYLOCOCCAL PHAGES (B4)

TAPHYLOCOCCUS (B3)
XU MICROCOCCUS PYOGENES (B3)

TARCH (D6)

TARVATION (C13)
ee also related:
FASTING (E2)
HUNGER (F)
XR FASTING (E2)
XR HUNGER (F)

TATE MEDICINE (G2)
X SOCIALIZED MEDICINE (G2)
XU MEDICAL CARE PLANS (G2)
XU NATIONAL HEALTH PROGRAMS (G2)

STATISTICS (H, I)
see also related:
PSYCHOMETRICS (F)

Status Lymphaticus see LYMPHATISM (C7)

STEAM (G3)

STEARIC ACID (D6)

Steatorrhea see SPRUE (C13)

Steatorrhea, Childhood see CELIAC DISEASE (C13)

Steel see under METALS (D1)

STEIN-LEVENTHAL SYNDROME (C6)

STELANGIUM (B3)

Stelazine see TRIFLUOPERAZINE (D4)

STELLATE GANGLION (A8)

STERILITY (C6, G1)

STERILITY, FEMALE (C6)

STERILITY, MALE (C6)

STERILIZATION (G3)

STERILIZATION, SEXUAL (E4)

STERNOCLAVICULAR JOINT (A2)

Sternocostal Joints see under RIBS (A2)

STERNUM (A2)
XU ENSIFORM CARTILAGE (A2)
XU MANUBRIUM (A2)
XU XIPHOID BONE (A2)

STEROIDS (D2, D5, D6)

STEROLS (D6)

Stethoscopy see under AUSCULTATION (E1)

STEVENS-JOHNSON SYNDROME (C12)

STIGMATIZATION (K)

STILBAMIDINES (D2, D3)

STILBENES (D2, D5, D8)
XU BENZESTROL (D2, D5, D8)
XU MESTILBOL (D2, D5, D8)
XU PROMETHESTROL (D2, D5, D8)

Stilbestrol see DIETHYLSTILBESTROL (D5)

Still's Disease see ARTHRITIS, JUVENILE RHEUMATOID (C3)

Medical Subject Headings

Figure 17

C - DISEASES

C8 - Cardiovascular Diseases

HEART DISEASES
HEMORRHAGE
VASCULAR DISEASES

- EURYSM
  - Aortic Aneurysm
  - Cerebral Aneurysm (C10)
  - Heart Aneurysm
- GINA PECTORIS
  - Coronary Disease
- GIOKERATOMA (C2)
- GIOMA, SCLEROSING (C2)
- GIOMATOSIS (C2)
- GIONEUROTIC EDEMA
- C9,C14)
- GIOSARCOMA (C2)
- RTIC ANEURYSM
- RTIC COARCTATION
- RTIC DISEASES
  - Aortic Aneurysm
  - Aortic Coarctation
  - Aortic Rupture
  - Aortic Stenosis
  - Leriche's Syndrome
- RTIC RUPTURE
- RTIC STENOSIS
- RTIC VALVE DISEASES
  - Aortic Stenosis
- RHYTHMIA
  - Arrhythmia, Sinus
  - Auricular Fibrillation
  - Auricular Flutter
  - Bradycardia
  - Extrasystole
  - Heart Block
  - Tachycardia
  - Ventricular Fibrillation
- RHYTHMIA, SINUS
- TERIOSCLEROSIS
  - Arteriosclerosis Obliterans
  - Cerebral Arteriosclerosis (C10)
- TERIOSCLEROSIS OBLI-
- ERANS
- TERITIS
  - Endarteritis
- ARTERITIS (Continued)
  - Periarteritis Nodosa (C3)
  - Temporal Arteritis (C3)
- AURICULAR FIBRILLATION
- AURICULAR FLUTTER
- AYERZA'S SYNDROME
- BRADYCARDIA
- BUNDLE-BRANCH BLOCK
- CARDIAC TAMPONADE
- CARDIOVASCULAR DISEASES
- CAROTID ARTERY DISEASES (C10)
- CEREBRAL ANEURYSM (C10)
- CEREBRAL ANOXIA (C10)
- CEREBRAL ARTERIOSCLEROSIS (C10)
- CEREBRAL ARTERY DISEASES (C10)
- CEREBRAL EMBOLISM AND THROMBOSIS (C10)
  - Sinus Thrombosis (C10)
- CEREBRAL HEMORRHAGE (C10)
  - Hematoma, Epidural (C10)
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- CEREBRAL ISCHEMIA, TRANSIENT (C10)
- CEREBROVASCULAR DISORDERS (C10)
  - Carotid Artery Diseases (C10)
  - Cerebral Aneurysm (C10)
  - Cerebral Anoxia (C10)
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  - Cerebral Artery Diseases (C10)
  - Cerebral Embolism and Thrombosis (C10)
  - Cerebral Hemorrhage (C10)
  - Cerebral Ischemia, Transient (C10)
- CHOREA (C10)
- CORONARY DISEASE
  - Angina Pectoris
  - Coronary Vessel Anom
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  - Myocardial Infarct
- CORONARY VESSEL ANOMALIES
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- DIABETIC ANGIOPATHIE
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    C11,C13)
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  (C7,C11,C13)
- DYSPNEA, PAROXYSMAL
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- EBSTEIN'S ANOMALY
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- EMBOLISM
  - Coronary Disease
  - Embolism, Air
  - Embolism, Amniotic Fluid (C6)
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- EMBOLISM, AIR
- EMBOLISM, AMNIOTIC FLUID (C6)
- EMBOLISM, FAT
- ENDARTERITIS
- ENDOCARDIAL FIBROELASTOSIS
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  - Endocarditis, Bacteria
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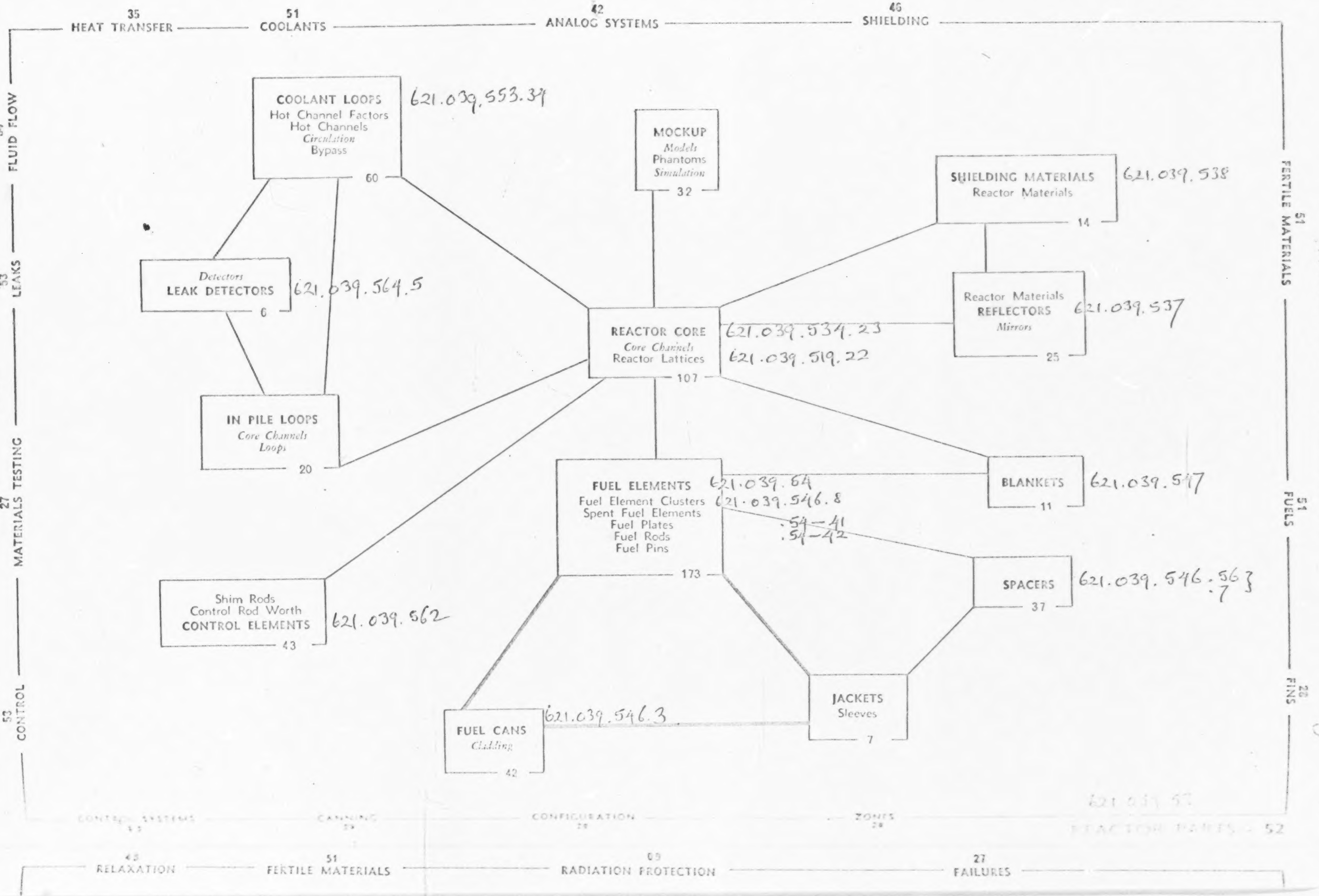
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